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EDITORIAL

A STRAW IN THE WIND

DR. KARL T. COMPTON, President of the Massachusetts Institute of Technology, in an address, "Engineering in an American Program for Social Progress," given at Johns Hopkins University, called attention to the important changes in engineering since the first engineering school in America was founded at Rensselaer one hundred and thirteen years ago. Although forest education is a somewhat more recent development in America, there are certain indications that it is undergoing somewhat similar changes. Therefore, a consideration of the transformation of engineering education may be of value in indicating the probable future trend in forest education.

Dr. Compton points out that in the early days of engineering education, the professional curriculum consisted of pure science, the applied sciences of the day, and the techniques of practical work in shops or in the field. As great industries developed, based on technological advances, the curriculum took on more of systematic training in the processes and techniques of these industries; it became more crowded with newer and newer specialties with a tendency to crowd out the basic sciences and to stuff the student with all the factual knowledge and techniques he might later be called upon to use.

Because large industries now prefer to train their own employees in the particular techniques and operations they use; and also because industries now demand that young engineers be so well grounded in the sciences and in the fundamental theories of engineering that they are capable of grappling effectively with the newest problems associated with technological progress; the character of engineering education is now changing. There is a tendency to reduce emphasis on shop practice; to postpone the specialized training to postgraduate years; to place more attention on the economic and social sciences; and to concentrate chiefly on basic sciences and fundamental engineering.

Forest education appears to have undergone the first stages of a somewhat similar transformation. Early instruction in professional forestry in America consisted largely of science courses already being offered by other departments of the university and such professional knowledge as was available at the time. Many older foresters believe that the character of forestry instruction of that day was superior to that of the present time, but there appears to be little if any valid basis for such an assumption.

As professional knowledge and experience broadened there has been and still

is a tendency, in certain quarters at least, to increase the professional offerings in the forestry curriculum, sometimes, but not always, at the expense of other courses formerly included. Such a change is not necessarily educational retrogression. It all depends on the character of the professional work offered. We seem to be extremely slow to grasp the fact that there is such a thing as *fundamental forestry*, just as there is fundamental engineering. To be sure, forest education also has its vocational and technological aspects, but the quality and quantity of professional forest education will never be greatly improved by stuffing forestry curricula with courses largely of this nature, important though they may be if sparingly used. No reference is here made to the relative amount of time that should be devoted to basic biological and social sciences and to professional courses, or to the significance of the contribution of these studies to the education of a forester. It is maintained only that such professional courses as are included in the forestry curricula should deal largely with fundamental forestry.

The character of the Junior Forester examination has had a profound influence on the trend of forest education in America. Governmental agencies selecting men from the Junior Forester register are the chief employers of forestry graduates. If special Forest Service techniques are emphasized in this examination, then special forest techniques, which may not be related even remotely to fundamental forestry, will find their way into the forestry curriculum. On the other hand, if the Junior Forester examination emphasizes the basic biological and social sciences and fundamental forestry, then the forestry curriculum will consist largely of courses pointed in that direction. No other single influence so profoundly affects forest education as does the character of the Junior Forester examination.

It is highly gratifying, therefore, that through the offices of the Society of American Foresters a joint committee from the Forest Service and the forest schools has been appointed to make a study of the character and objectives of the Junior Forester examination. A preliminary report of this committee states that, in general, the aim of the examination should be to determine the breadth and soundness of the candidate's training in fundamentals, rather than his knowledge of the details of some particular branch of forestry.

If the Junior Forester examinations tend more and more to determine the breadth and soundness of the candidate's training, we may confidently expect to find forest education placing increasing emphasis on fundamental forestry to the mutual benefit of both forest school graduates and the profession.

No profession can rise far above the level of the institutions which train men for that profession. The forest schools cannot escape a large share of the ultimate responsibility for the course and progress of forestry in America. They should, therefore, take advantage of every possible opportunity which will raise the standards of forest education. Undoubtedly, much honest difference of opinion exists with respect to how forest education should develop; but if the changes which engineering education has undergone are any indication of the changes forest education will undergo, forestry curricula of tomorrow will emphasize practical procedures and techniques less and fundamental forestry more.

HENRY CLEPPER

By HERBERT A. SMITH

THE President of the Society of American Foresters has announced the election by the Council of Henry Clepper to succeed Franklin Reed as Executive Secretary. Following that announcement, a brief statement regarding the new incumbent's professional record is in order.

Born and reared a Pennsylvanian, Clepper received his B.F. degree from the State Forest Academy at Mont Alto in 1921. He was then twenty years old. The following September he entered the Pennsylvania Forest Service. Gifford Pinchot, as State Commissioner of Forestry, was at that time infusing the Department, from top to bottom, with new vigor and enthusiasm; and partly under that influence, Clepper looked forward eagerly to a lifetime of service in his own state. His first assignments were in the anthracite region, where fire control constitutes the major administrative problem. Beginning as forest inspector in the Lackawanna district, he was promoted in 1926 to acting district forester and in 1928 to district forester in charge of the neighboring Weiser district.

Early in 1929 it was decided to inaugurate measures for the control of the white pine blister rust in Pennsylvania, and Clepper was selected to organize the work. From this assignment he was promoted in September to senior research forester and business manager of the Pennsylvania Forest Research Institute at Mont Alto. His special research projects here concerned wildlife management and fire control.

In 1931 he was called to Harrisburg, as assistant chief of the Department's Bureau of Research and Information, and was placed in immediate charge of the editorial and publication activities, together with special research studies. Early in 1935 he was transferred back to Mont Alto to take full charge both of the forest experiment station there and of the State Forest and nursery. This Forest, which has been under sustained yield management for 35 years, is the state's experimental forest; its nursery, the oldest in Pennsylvania, produces 2½ million trees annually; and its supervision ranks as one of the foremost field responsibilities in the State Forest Service. In October, 1936, Clepper resigned from this position to enter the U. S. Forest Service, Division of Information and Education.

In short, our new Executive Secretary has had approximately seventeen years of diversified experience in field and office; in executive tasks, in research, and in promotional and educational activities. In addition to being the author of various official publications he has written extensively on his own initiative for magazines and newspapers, has contributed often to the JOURNAL OF FORESTRY and *American Forests*, and has been for the past three years an Associate Editor of the JOURNAL. He has also had experience in public speaking, radio writing, and motion picture direction. He is keenly interested in writing and whatever has to do with writing. In initiative, resourcefulness, tact, and level-headed judgment combined with high integrity of character he is believed by those who know him well to possess a native endowment which should bring success in the difficult task now falling to him.

Henry E. Clepper

RUFFED GROUSE MANAGEMENT[1]

By RALPH T. KING

University of Minnesota

The ruffed grouse is the most important upland game bird of the forested areas of the northern and eastern United States. Its numbers can be increased through reduction of mortality on existent ranges and through the creation of additional satisfactory ranges. Management measures for the accomplishment of these purposes are indicated by researches carried on for the past seven years. Certain of these measures are described in the following paper. They illustrate the necessity of keeping both the requirements and the habits of the wildlife species in mind, and the fact that good wildlife management is not contrary to good forest management.

THIS discussion includes a consideration of only those research results which are immediately and directly applicable to the problem of producing more ruffed grouse. The investigations on which these recommendations are based were carried on in North Central Minnesota for the past seven years, and the recommendations are intended to apply to conditions prevailing in that region.

Greater productivity of ruffed grouse can be accomplished by two methods; (1) greater survival on present grouse ranges, and (2) creation of more grouse range. Both methods should be used. They are essentially the same inasmuch as both involve reducing environmental resistance. On occupied range this means greater survival; on unoccupied range it means removing the barrier to occupancy. On either type of range it must be accomplished through environmental controls, that is, through manipulations of certain of the environmental constituents.

The problem of productivity in the case of ruffed grouse is complicated by the fact that a cyclic species is dealt with. Superimposed upon the normal and regular losses—the usual annual oscillations—there is the additional difficulty of periodic and, at present uncontrollable, large losses which, at approximately ten-year intervals, wipe out about ninety per cent of the entire stock.

These definitely proven cyclic decimations mean that we can have ruffed grouse shooting only so many years out of every ten. We may as well face the facts—we must make up our minds that we must forego shooting during certain years. Closed terms are necessary if we are to maintain a sufficient breeding reserve, and paradoxical as it may sound, they are absolutely essential if we are to have the largest number of open years with good grouse shooting during any ten-year period.

This, then, leaves three major questions in ruffed grouse management. These are:

1. How can we determine in advance which years should be open for ruffed grouse shooting?
2. How can we provide for the greatest number of such open years in every ten-year period?
3. How can we provide the greatest amount of grouse shooting during each of these open years?

Many of the recommendations included in the answers to these three questions are based on the accumulated knowledge of cyclic behavior. Much of the knowledge relating to cycles is recent and as yet unpublished.

The question of determining in advance which years should be open for grouse shooting can now be answered with certainty. An accurate and practicable census method has been devised which makes

[1]Paper No. 1497 of the Scientific Journal Series of the Minnesota Agricultural Experiment Station.

it possible for anyone with a knowledge of grouse range and grouse habits to determine within a reasonable degree of accuracy the total population of ruffed grouse on areas of any size. This method can be used ten months out of the year in any type of ruffed grouse country and under most weather conditions. An experienced man can census from 1,000 to 1,500 acres per day. Population figures obtained by careful censusing through the use of this, or some other reliable, method provides the only sound basis for determining which years should be open for shooting. Furthermore, continued use of a reliable census method on representative sample areas will enable one to detect the first signs of approaching decimation. The evidence of an impending crash is present and recognizable far enough in advance to allow for their use in deciding the matter of open seasons, bag limits, open territories, and similar game administration problems which should be and must be decided according to prevailing conditions if we are to have anything deserving of the name of management.

On Minnesota areas we were able, through the use of censuses, to demonstrate losses due to current decimation as early as May. These losses were not demonstrable by any other method until much later in the year; in most instances not until after the usual dates of the grouse hunting season.

The provision of the greatest number of open years in every ten-year period is almost wholly a matter of building up and maintaining the maximum breeding population. According to the results obtained in Minnesota during the past seven years the maximum breeding population of ruffed grouse is one bird per four acres. We have not found in any year or on any area an April population in excess of this figure. On our control area, where no shooting is permitted, this was the April figure for three consecutive years in spite of great differences in the October populations of the preceding years. These differences are shown in Table 1.

The area on which these figures were obtained consisted of 1,800 acres of good grouse range. Similar areas have shown approximately the same figures for overwintering populations, while poorer areas have consistently shown April densities of less than one bird per four acres.

If even the best grouse range can not overwinter grouse populations in excess of one bird per four acres we must then accept this figure as a measure of the maximum breeding population. The reason for this upper limit of population is still to be determined. Various possible explanations come to mind; none of them has been proven. Two of the likeliest are the species' intolerance of greater crowding or the exercise of individual territorial rights.

Whatever the explanation, there is apparently a very definite upper limit, and this limit is the first of the factors that operate to determine the size of the fall population. If, however, the April population is less than one bird per four acres it is sufficient proof that the range is lacking in some important essential. The first essential, of course, is an October

TABLE 1

THE OCTOBER AND APRIL GROUSE POPULATION ON 1,800 ACRES OF GROUSE RANGE IN NORTHERN MINNESOTA

Year	October population	Acres per bird	April population	Acres per bird
1931	525	3.4		
1932	750	2.4	443	4.1
1933	995	1.8	455	4.0
1934			452	4.0

population in excess of the desired April population. It must be in excess in order to allow for winter losses. We have found these winter losses, on properly stocked and understocked ranges, normally to be approximately seventeen per cent. It is perhaps safer to figure on a twenty per cent loss. This means that the population present on the range at the beginning of the winter will be reduced by one-fifth before April and proper allowance for this reduction must be made.

If winter losses exceed twenty per cent of the fall populations the fault lies in the environment and must be sought for and corrected there. This fault is very apt to be a deficiency in cover. The kinds of cover necessary will be referred to later. One other requirement must be provided on any range where the object is to build up and maintain the maximum breeding population, that is practically perfect interspersion. The species' saturation point can not be exceeded for the whole range, neither can it be exceeded for any part of the range except very temporarily. It is obvious, then, that each unit of the range as determined by this species' saturation point—four acres in this case—must produce its proportion of the total range population. There can be no permanent crowding of birds into concentrations in excess of this saturation point; therefore, there can be no blanks in the sense of areas lacking in any single grouse essential if it is intended that the range shall maintain its maximum population.

The maximum breeding population is the species' saturation point and is the largest possible overwintering population. To obtain it it is necessary to provide:

1. A fall population twenty per cent larger than the largest possible overwintering population.
2. A grouse range containing all of the winter requirements for ruffed grouse.
3. A degree of interspersion that will allow each unit of the range to produce and support its proportion of the total maximum population.

Providing the greatest amount of grouse shooting during each of the open years is wholly a matter of productivity (granting the maximum breeding population). There are a number of factors that reduce productivity and all of them together are responsible for quite large losses.

The greatest single loss is juvenile mortality. This is an annual loss—separate from and in addition to the periodic cyclic losses. It is normally at least 75 per cent, some years even larger. The causes are numerous, but so far all of these causes can be included under eight general headings. The first of these juvenile losses in point of time is nest destruction. For purposes of this discussion nest abandonment due either to desertion or death of the hen is included under nest destruction. We know of only two instances where incubating hens have been killed by accidents or predators. We know of only one instance where a hen has deserted her nest, and this in spite of the fact that well over one hundred nests have been found before the clutches were completed and visited every day from the time of finding until they hatched. All in all the several hundred nests for which we have records show nest destruction from all causes to be slightly less than three per cent. Although we could not positively identify the predator responsible for each of these nest losses we do know that one was the work of a wild-ranging house cat, another was the result of red squirrel activity, and a third was the work of a woodchuck.

A second type of nesting loss is due to the disappearance of one or a few eggs from the nest without destruction of the entire clutch. Such losses have occurred in approximately 30 per cent of the nests under observation but they did not average two eggs per nest and accounted for slightly less than five per cent of all the

eggs under observation. Both red squirrels and chipmunks have been observed to take eggs from grouse nests during the absence of the hen. We have no reason to believe that either species deliberately searches for nests or possesses any particular ability to locate them. It seems in each instance that they happen onto the nest wholly by accident. Chipmunks have never been observed to break or attempt to break the eggs. They simply remove one or more of the eggs by rolling them up out of the nest, play with them for a time, much as a kitten plays with a ball, and then they invariably hide them under moss, leaves, bits of wood, or any other object under which they are able to push them. On several occasions complete clutches of eggs have been recovered from such hiding places, replaced in the nest, and successfully hatched.

Red squirrels have been observed to remove an egg, carry it away a few yards, break into it, and if it does not contain a chick well advanced in incubation, discard it and go on about their business, paying no further attention to the nest. If, however, the egg contains a fully formed chick it is eaten and other eggs are removed and their contents eaten until all the eggs are gone or until the squirrel's appetite is satisfied. It seems quite probable that most of the losses involving one or two eggs from a clutch are to be accounted for by this sampling habit of red squirrels.

The very large losses of chicks in the first 30 days after hatching are not yet explained satisfactorily. It has been almost impossible to find the dead young birds. The few that have been found in condition for examination have been submitted to bacteriologists and parasitologists. So far they have not been able to determine the presence of any disease that would account for this very high juvenile death rate. The presence of several species of parasites, both internal and external, has been demonstrated in very young birds but there is as yet no proof that these parasites are responsible for any appreciable share of the losses.

Accidents are responsible for a part of this juvenile mortality but such losses are usually not important except on areas that are much traveled. The hen with her young is attracted to openings because a number of things that enter largely into their daily life either occur only in connection with such openings or are found more abundantly in such locations, for example: dry mineral soil for dusting, gravel, succulent vegetation, and abundant insect populations. Roadsides offer all of these attractions, and if roads are numerous and frequently traveled, especially by automobiles, a considerable loss of young birds will result.

All of these things that attract the birds to roadways can be provided in other locations. Small openings can be made in heavily wooded areas without sacrificing valuable timber. These openings need not be wider than twice the height of the bordering trees. The increased herbaceous growth which naturally occurs in open areas will provide a greater quantity of succulent vegetation and an increased insect population. If occasional small mounds of mineral soil are thrown up in the borders of these openings they will provide dusting scrapes and a source of gravel. If the slashings resulting from the clearing operations are piled and burned at the edges of the clearing they will provide most desirable dusting scrapes. Burning out in the opening should be avoided; the remaining ash pile is too deficient in cover. In this connection it is well to keep in mind the value of woodchucks, the earth thrown out at the mouths of their burrows furnish one of the best sources of gravel available to ruffed grouse and usually in locations where there is little danger of accidents befalling the birds as they make use of it. Both artificial and natural openings can usually be further improved

by seeding them with either alsike or white clover. Removal of the brush and sod or duff is necessary. The resulting growth provides an abundance of succulent foliage and is valuable in other respects. These additional values will be discussed in connection with summer range.

Losses of young birds due to predation are insignificant in so far as we have been able to determine. It has been suggested by some that the creation of openings attractive to young birds would result in increased losses from predators. We have not found this to be the case. It is true, of course, that cover is essential to provide protection, but such cover need not be ten to twenty feet above the ground. In practically any opening attractive to grouse there will be a fairly rank growth of ground cover plants, in our region it is bracken fern. By the time the eggs are hatched this cover is well up and open and provides a fairly continuous canopy some 15 to 30 inches above the ground. This type of cover seems to be even more efficient than that provided by plants forming higher canopies.

A number of very young birds die each year as a result of falling into depressions from which they can not escape. During the first few days of their life any depression with vertical walls and more than two or three inches deep is a veritable death trap, and if it contains an inch or more of water, as most of them do at that time, it need be neither so deep nor so steep to be equally deadly. Devoted to her young as the mother grouse is, she has not yet learned how to rescue them from these all too common pitfalls. Losses from this cause I believe to be the second largest of all the losses befalling ruffed grouse. At first glance it seems as though nothing could be done about it. Actually, however, this extremely pessimistic view is not wholly justified. The provision of openings as suggested earlier in this paper will provide more desirable nesting sites and it has been our experience that grouse respond quickly to such improvements in their environment. If improved nesting range is available on relatively undisturbed upland areas fewer birds will be compelled to locate their nests in muskegs and swamps. It is in these last mentioned locations that depressions are most numerous and during the period immediately after hatching these depressions usually contain ice-cold water. The old grouse very soon leads her brood into these same locations in order to escape the midday heat of summer but by that time they are large enough and strong enough either to avoid these pitfalls or to escape from them in case they do fall in. This type of loss is limited to a period of a very few days in the early life of the birds.

Probably the greatest loss of young birds is due to a condition existing before they are hatched. We can offer no proof that this is the case but we have good reason to believe that it is. It goes back to that period in the life of the hen when the eggs from which the young are to be hatched are forming in her body. Each chick must undergo 24 days of development within the egg and emerge strong and vigorous if he is to leave the nest within a few minutes after hatching and keep up with his brothers and sisters as they range the woods with the mother; and each chick must do this if he is to survive. Certainly strong and vigorous chicks can not be hatched from eggs lacking in either quantity or quality of food. All of this food necessary for a clutch of from 10-15 eggs must be provided from the tissues of the mother during a period of year when food is reduced to a minimum both as to quantity and variety.

We do not know which foods are most desirable or most necessary at this time of year but we do know that only a few kinds are available. The bird's weight curve shows a rapid drop during this period. This loss in weight is no doubt

due in part to the increased activity incident to mating but a large share of it is perhaps equally well accounted for by the poorer quality and reduced quantity of food. At this time when food conditions are at their worst for the entire twelve-month period, and immediately following the long rigorous period of winter the birds are called upon to meet the greatest physical drain of the year, that is, mating and reproduction. Reasoning by analogy with domestic animals it seems logical to assume that such extreme conditions must of necessity result in reduced vitality of the subsequent broods. It is therefore highly probable that any improvement in food conditions during late winter and early spring will result in lessened juvenile mortality and a consequent increase in the survival rate.

The kinds of foods most apt to prove valuable in this connection are evergreens providing acceptable leafy foods such as clovers and strawberry, and fruit producing species which retain their fruits over winter and do not grow to a height that exposes these fruits above the snow. The leafy evergreens should occur in connection with openings where they will be available earliest when the snow begins to melt. If planted, they should whenever possible, be located on south-facing slopes. The fruiting species will be most valuable in this connection if their fruits are less palatable than those of the other species present in the region. This will tend to discourage their use in the fall and early winter when there is usually an abundance of other foods available. They should also be low-growing, preferably with their fruits above the surface of the ground but not so high as to carry them above the snow line, that is, actually buried in the snow, not under it. This makes it difficult for the nonhibernating, surface feeding mammals to get at them and makes them unavailable to winter birds until the snows are melting, the period when they most need such additional food. The two species we have found most desirable in these respects are bear-berry (*Arctostaphylos uva-ursi*) and Japanese barberry (*Berberis japonica*). Both wild grape and Virginia creeper will help to meet these needs if it is so arranged that they trail over the looped branches of down trees or over flattened brush heap, where they will be covered with snow.

Artificial winter feeding, in so far as ruffed grouse are concerned, is impractical and uneconomical. On the great bulk of our grouse range it is absolutely impossible because of inaccessibility.

The importance of even a slight reduction in the mortality rate should be apparent to anyone who has any knowledge of wild animal population behavior. Fortunately for our management efforts the smallest reduction in the case of the majority of species results in a disproportionately large increase in the survival rate. If this lessening of the mortality rate can be accomplished during the juvenile period it automatically results in increased productivity in the form of additional allowable hunting take. This point is demonstrated in the following illustration: assuming that the sex ratio is fifty-fifty and that each newly hatched brood consists of ten young (neither of these assumptions is absolutely correct but they approximate the truth close enough for purpose of illustration), if all of these young survived each family, which originally included only two birds, would at the end of the first year include twelve birds, a 600 per cent increase. Of course they do not all survive, and no one believes that it will ever be possible to bring about 100 per cent survival. The question is: How many do survive? In a grouse population where no increase is occurring none of them survives. If the numbers of grouse remain the same year after year, then there can not be more than two birds of each family surviving each year. If more than that num-

ber survived there would be an increase. Under these conditions ten grouse equal 100 per cent of the mortality in each family; then one grouse equals ten per cent of the total mortality. If the mortality rate could be reduced as much as ten per cent, leaving three grouse alive at the end of the year, instead of two, there would be a 50 per cent increase in survival and a doubled grouse population in two years.

Any reduction in juvenile mortality will pay large returns in the form of increased productivity, particularly in the form of increased shootable surpluses. If our wildlife conservation efforts are to be productive of the greatest amount of good they might well begin to give some consideration to the next year's brood of young in the year previous to their hatching, instead of devoting all their energies to the saving of the last year's brood in the year following their appearance. It is not unlikely that a great part of our conservation work has been directed toward the saving of birds already dead for several months.

Cover is just as essential as food, and several different kinds are necessary on a successful grouse range. The more important types are: drumming cover, nesting cover, brooding cover, molting cover, and winter cover. In most cases the cover pattern is more important than the plant species involved. Cover areas need not be extensive, and the more effective the plant growth is as cover the more important it is to see that these areas are broken up and interspersed with open areas; otherwise there will be little or no food produced at the ground surface, and food in this location is essential to the young birds and highly important to the old ones. Effective cover existing over too large an area will defeat its own purposes.

Drumming cover, containing one or more logs, particularly must be widely dispersed over the range. Each male grouse selects his own area and territory over which he exercises complete control; no other male is permitted on that territory. If drumming cover is concentrated in a few places with large blank areas intervening the excess of such cover in any drumming territory will not provide for additional grouse in that territory and the blank spaces will provide either very poor and very dangerous drumming grounds or they will not be utilized at all. In either case productivity is lessened.

The importance of properly distributed nesting cover in the right locations was mentioned in connection with juvenile mortality. One further point to be re-

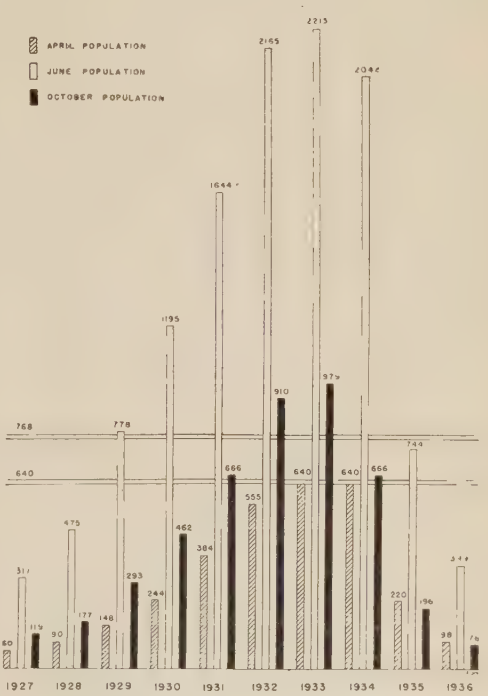

Fig. 1.—Ruffed grouse population over a ten-year period on a 2,560 acre area. The values for 1927-29 are calculated. The lower double horizontal line represents the maximum overwintering population, which is the maximum spring breeding population obtainable. The upper double horizontal line represents the maximum late fall population necessary to allow for overwintering losses and to provide the maximum spring population.

membered in connection with nesting cover is the importance of openings. Nests are almost invariably located in the edges of openings, perhaps because of the increased number of insects available to the young in these openings. At any rate such openings do increase the quantity and the variety of foods available and the more abundant they are the less the danger of nest concentrations. In regions where openings consist almost wholly of roads, trails, and paths most of the nests will be located along the sides of these openings and thus exposed to increased danger: first, because of concentration, second, because many nest-destroying species use these same roads and trails, and third, because of accidents to the young.

Ideal brooding cover is a low, dense canopy adjoining openings containing a variety of plant and insect life. The plants must be low-growing (ground cover) if they are to be available to the young, and the greater the variety of plants the greater the number and kinds of insect and plant materials present. Although such cover is utilized for only a short period it is nevertheless highly important that it be available during that period. It is during that same short period that we lose approximately 75 per cent of our annual increase each year.

Molting cover should be dense and difficult of penetration. This is where the birds retire nightly and during much of the day from mid-July to September. It must offer protection from summer heat as well as from enemies. During this period the young are still making a rapid growth and both they and the adults are growing their new plumage. There is an increased physical drain at this time as well as increased danger because of reduced abilities, especially the ability to fly. Rank growths in moist areas are most attractive and apparently most effective at this time; these may be dense cedar, spruce, or balsam thickets bordering swamps, dense alder fringes on lake or stream shores, particularly if they are covered with a matted growth of vining plants, or tangles of raspberry, blackberry, gooseberry, or currants in moister locations. If such areas do not provide surface water in some form provision should be made for the growth of berry-producing plants.

Winter cover for ruffed grouse must provide protection from extreme weather conditions and roosting places safe from predators. In the northern part of their range, snow ordinarily meets both of these requirements. Where snow occurs to a depth of twelve inches or more and is not crusted the birds deliberately dive into it; they not only roost under the snow at night, but we have found that they spend a great part of each day under its protection when temperatures are near or below zero. On our grouse ranges there is always a sufficient depth of snow to provide excellent protection, and it is usually not crusted to the extent that the birds cannot utilize it. There are, however, years in which a sufficient depth of snow has not fallen by the time the deciduous trees have lost their leaves; under these conditions the birds are exposed to the effects of low temperatures and bad storms, and to the attacks of predators—mammalian if they roost on the ground, avian if they roost in the trees. Furthermore we occasionally have severe ice storms during the winter which put a crust on the snow that no bird can break through. This condition also forces them to roost in trees. At such times when snow protection is not available the next best protection is provided by clumps or fringes of balsam, spruce, or cedar. Pines do not furnish good winter cover except as young dense stands. At about 15 years of age they outgrow their usefulness in this respect.

If snow could be depended upon each winter all winter long, there would be no need to worry about coniferous cover.

Unfortunately it can not be depended upon for the reasons just mentioned. It is, therefore, essential that coniferous cover be provided, even though this cover is necessary only once in every several years. Much of wildlife management is in the nature of insurance against future probable contingencies. A two-day ice storm once in five years can do away with all of the increase built up during that period unless the management measures have taken account of and provided for the ice storm.

The water requirements of ruffed grouse usually offer no problem during most of the year. For several months out of the year snow provides all of their needs in this connection. For a period of several weeks after the snows begin melting the temporary snow pools furnish readily available water widely distributed. By the time the snow pools are gone young and succulent vegetation is available everywhere; there may also be dew. Before the leafy materials have grown beyond the stage where they supply sufficient moisture, the first juicy fruits and berries, and insects are present in numbers. This condition prevails until late in the summer. There is, however, a short period, usually only three or four weeks long, late in the summer and early in the fall when the problem of moisture to meet their needs becomes acute. There is usually at this time neither dew nor frost, it is too early for snow, most leafy materials have lost their succulence, and the juicier fruits and berries have largely disappeared. It is during this same period that the birds begin eating buds and there is evidence to indicate that this activity greatly increased their need for moisture. Birds near ponds, lakes, and streams can readily supply this need, but those birds farther removed from these surface waters are dependent upon some other source of supply. The best natural source of supply is some evergreen ground cover species such as clover or strawberry. These species grow well in openings where some mineral soil is exposed. They are frequently found along wood roads and everyone familiar with ruffed grouse knows that these birds are also found in these roads in large numbers for a period of a few weeks during the fall. The usual explanation is that they are out there for gravel, actually they are there for the moisture to be obtained from the clover and strawberry leaves. Their gravel requirements are no greater at this season than any other. A better distribution of these plant species over the range, that is, increased interspersion, will result in more productive acres, and will reduce to a considerable extent these concentrations on roads and thereby eliminate some losses from poaching, predation, and accidents.

The importance of interspersion was pointed out earlier in this paper. A number of ruffed grouse requirements have been mentioned. Each of these requirements is an essential on any northern grouse range. No block of grouse range can support its maximum overwintering population unless these various essentials are so interspersed over the entire range as to enable each unit of the range to support its proportion of that total maximum population. This maximum overwintering population is the maximum breeding population.

The allowable shootable population is the excess over the maximum breeding population plus 20 per cent. The accompanying chart illustrates this for an area of 2,560 acres. If this entire area consists of good grouse range its maximum breeding population is 640 birds. In order to have 640 birds present in April it is necessary to start into the winter with 25 per cent more than that number, that is, 800 birds. Any birds in excess of 800 in October are allowable shootable take. In order to have the largest possible shootable take it is necessary to have, first, the largest possible breeding population

and second, the smallest possible loss between the hatching season and the shooting season.

The largest possible breeding population is 640 birds. During normal years this population will provide approximately 300 mated pairs, and these will average ten young each, an increase of 3,000 birds. Normally these young will be reduced by 75 per cent before October, that is to 750, and the adults by ten per cent in the same period, that is to 576. This will leave an October population of 1,326. In order to allow for 800 to start into the winter only 526 can be taken. If any method or combination of methods could succeed in reducing the juvenile death rate by so much as 13 per cent we could bring through to fall one additional bird in each family group and thus increase the allowable shootable take from 526 to 826 which is an increase in productivity of 57 per cent.

It is well to point out in this connection that this so-called allowable shootable take is actually surplus population; it is made up entirely of birds that can not survive the winter. Shooting limited to this part of the population can in no wise affect the continued existence of the species, and it is only when shooting is limited to these surpluses that it can properly be included under the term conservation. No species can be rightly included on the game list unless we know enough about that species to enable it to produce surplus populations and until we can demonstrate that such surplus populations actually exist. It is understood that shooting should always be limited to these surpluses.

There are two additional points that must be kept in mind in any discussion of ruffed grouse management. Both are important and both arise from the cyclic nature of this species. It has been argued by some that heavy shooting of the birds during the upswing of the cycle would tend to reduce the severity of the cyclic decline or perhaps do away entirely with the decline. This is an absurd and vicious idea. On the basis of our present knowledge of cycles there is no reason whatever for believing that shooting will in any way either delay or reduce the cyclic losses. This suggestion that shooting might be beneficial was first made in the belief that the declines were the result of an overpopulation; it was held that as soon as the population level had attained a certain height a "crash" must inevitably occur. It is now known that this is not the case. On many areas peak populations have been maintained for three and four years, and when the "crash" comes it includes all areas, those on which there are peak populations and those on which there are very sparse populations. Cyclic declines are not the result of overpopulations and can be neither eliminated nor reduced in severity by increased shooting.

The second point is the importance of saving a maximum number of the older age classes at the beginning and during the low point of the decline. There is evidence to indicate that only those birds born four, five, and six years before the "crash" have sufficient stamina and reserve strength to carry them over the decline. It is this group of older birds that makes up the group of survivors and furnishes the breeding stock responsible for the next cyclic recovery. Every protection should be provided the birds from the very beginning of the decline, for any loss in this relatively small age group will seriously retard the recovery rate.

WHAT IS FORESTRY?

By S. O. HEIBERG
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A considerable amount of space has been devoted to a consideration of the desirability of establishing minimum instruction in forestry requirements for Junior membership in the Society. This is an important question and before it is finally settled much more space probably will have been devoted to its consideration. In the following paper, by Professor Heiberg, the technical procedures of forestry are divided into three well defined groups, namely: extractive forestry, preservative forestry, and reproductive forestry. The province and objectives of each of these groups is discussed in detail.

PROFESSOR Chapman's article in the January 1937 issue of the JOURNAL OF FORESTRY entitled "Provision for Minimum Instruction in Forestry as Basis for Junior Membership" raises this question: What is Forestry?

The present general conception of forestry has been greatly influenced by Fernow's definition (2, p. 95), which defines forestry as "the rational treatment of forests for forest purposes." However, if we analyze this definition critically we find, provided we coordinate the word forestry with farming, mining, fishing, etc., that forestry is not a *treatment* but a use. Forestry is not necessarily *rational* but purposeful, and we certainly do not use the forests—or even treat them—for *forest purposes*, but rather for human benefit. History shows that all human dealings with the forest have been aimed for human advantage, never for the sole concern of the forest. Consequently the definition of forestry may be "*the purposeful use of forest for human benefit.*"

In most current definitions we find that forestry includes the production, the tending, the protection, and the utilization of forests; but is this necessarily so?

With Howard Grön (3, pp. 14-15) we may divide the technical procedures of forestry into three sharply defined groups dependent upon the specific objectives sought and the means by which these are attained: namely, 1. extractive forestry (forest exploitation), 2. preservative forestry (forest preservation), and 3. reproductive forestry (sustained forest production).

As early as 1876 P. E. Müller (4, p. 31), in contrast to Pressler (5) and other forest economists of the German school, distinguished between extractive and productive forestry. In his classification Müller was influenced by the French economist, Dunoyer, who distinguished between the extractive usages such as coal mining and the productive usages such as farming. Müller points out that while most other usages must necessarliy fall into one or the other of the two categories, forestry, by its very nature, may appear both as extractive and as productive usage. When Müller wrote his article, forestry in Central Europe was primarily productive while forestry in Sweden, Norway, and Finland was almost purely extractive. Howard Grön added a third group, preservative forestry, and changed the name of productive forestry to reproductive forestry. He points out that extractive, preservative, and reproductive forestry are all producing, while the significant phase of reproductive forestry is its reproductive aspects.

Extractive forestry concerns itself only with the utilization of forest. Its sole purpose is utilization. Although it may protect its raw materials and capital investments as long as the utilization process goes on, it does not in its purposes include the reestablishment of the raw material. Such forest usage is frequently compared with mining but a better com-

parison, to my mind, is fishing, especially marine fishing. The forest very often reproduces itself spontaneously, as do fish, but by excessive and careless use the wood supply, as the fish supply, may be exhausted.

Up until about 50 years ago extractive forestry was the common use to which forests were put throughout the world and even today the major part of all forest land in the United States, outside of the publicly owned and controlled forests, is run on this basis. In fact investment of capital, technique, labor, taxes, prices, and profits are still firmly adjusted to this kind of forestry. The purposeful tending, and the reproduction of forests have no place in pure extractive forestry.

Preservative forestry is the maintenance of the existing forest conditions with their direct useful effect as the objective. The production of wood is usually of secondary importance and an instrument for the improvement and use of forest recreation, wildlife management, forest influences, etc., rather than a goal in itself.

We find splendid examples of preservative forestry in most of the National and State Forests, and also in the National and State Parks such for example as the Adirondack state forest preserve in New York. Protection is always a major technique used for this kind of forestry while reproduction, tending, and utilization (of wood products) may or may not be employed.

Reproductive forestry is the sustained utilization of the products originating from the production factors of the forest. Work toward this type of forest usage has already begun on parts of many public and on some private forests in this country. The need for the expansion of reproductive forestry has been established; the social need, especially, has been clearly demonstrated. But investment of capital, technique, labor, taxes, prices, and profits are not adjusted to this kind of forestry and methods for transforming extractive forestry into reproductive forestry are just beginning to be developed.

Professional forestry education has occupied itself primarily with reproductive forestry, in fact to such an extent that other methods of forest usage are just beginning to be recognized as forestry. Only limited cooperation exists between forestry education and the practical field of extractive forestry. Most theories and methods which professional forestry education advocates have been strongly influenced by the literature and practice of forestry in countries in which training in professional forestry originated after reproductive forestry had become thoroughly established. Few graduates of forest schools have therefore been able to obtain employment or in fact obtain training for employment, in private forestry which possesses the most valuable forests both from an extractive and a reproductive forestry viewpoint.

In reproductive forestry the reproduction, the tending, the protection, and the utilization of forest enters as a part of the business procedure.

Generally, the conception of the term forestry has been confined to reproductive forestry. However, if we coordinate the term forestry with farming, mining, fishing, etc., it should include all phases of forest usage and not just that branch which presupposes the continued use. If forestry and reproductive forestry are to be considered as synonymous, a new term must be found to cover all that which comes under the purposeful use of the forest. Perhaps *foresting* would be such a word. However, I believe it is better to clarify the term forestry than to introduce a new term.

If the profession of forestry disowns extractive and preservative forestry and identifies itself solely with reproductive forestry, it leaves itself without much firm ground upon which to stand. The future may show a rapid increase of the forest

areas on which sustained forest usage is introduced. But economic planning may lead the way toward a rapid increase of pure preservative forestry while it perhaps will be on only a minor percentage of the total forest area that real reproductive forestry will and should be practiced. Meanwhile should the profession of forestry lead the way only toward reproductive forestry and stand or fall by this leadership or should it at all times stand for the purposeful use of the forest and lead the way toward the best kind of forestry, whatever the circumstances may require?

The Society of American Foresters includes men professionally trained for forestry and I personally believe in a high professional standing. But I would not exclude from the Society foresters who are professionally trained in other branches of forestry than reproductive forestry. I do not believe this to be correct or wise. The man who is professionally well trained in extractive forestry is a most valuable member of the Society. He is in a position to contribute in an important field with which many members are unacquainted. He may well serve to bring the too theoretical and too idealistic members down to the world of realities. Indirectly, he may in this way advance the cause of reproductive forestry. Without him the Society would hardly be a true Society of American Foresters because he represents in a truer sense American forestry of today than the man who is trained for reproductive forestry. Rather than discourage the utilization-minded man, the Society should do all in its power to welcome him into its ranks. If he is excluded, the day may not be far distant when he will form his own society and then it will be a question as to which group the public and the legislatures will choose to listen. It would be to the advantage of the Society to have the points which divide foresters discussed within the Society rather than outside, or perhaps not discussed at all. It is, however, through discussions of vital questions rather than through the exclusion of men who may have a different point of view that forestry advances.

In conclusion let me say that if a necessity exists for adjusting the minimum requirements for Junior membership in the Society to present day conditions, the basis for such changes must rest on the question: *What is forestry?*

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LAND USE AND FOREST PROTECTION IN SOUTHWESTERN OREGON

By J. W. FERGUSON

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The problem of land-use planning, if conscientiously approached, is seldom an easy one. When coupled with it are issues as controversial as those involved in conflicting industrial interests and opposing conceptions of property rights, the solution is doubly difficult. Consequently, the forester attempting to establish a publicly supported protection policy in the midst of such clashing forces finds himself confronted by one of the most difficult of public relations jobs. The author describes such an involved situation in Oregon and discusses the procedure for correcting it.

LAND use in the marginal area of southwestern Oregon has developed into a controversial problem between the livestock industry and the foresters. There is one basic fact which supports both sides. Investigations of the Pacific Northwest Forest Experiment Station reveal that practically the entire area involved in this controversial issue is classed as Sites I and II, and hence will produce some of our best forests. It is also true that these sites produce our best grazing. It becomes then a problem in economics; which use of the land will eventually produce the greater income? Additional research is necessary before this question can be answered.

Perhaps foresters have been delinquent in their cooperative attitude, and the same criticism can be made of those who believe grazing development is the better use. We cannot question their beliefs or motives. There has been too much criticism on each side and too little studied effort to meet cooperatively and attempt mutually to solve the problems. Another criticism is the fact that too many agencies have worked on the problem independently of each other, which has resulted in findings and reports that add additional fuel to the controversy.

History shows that with the exception of some agricultural land, swamps, and bottom lands in the valley, the country was at one time practically all forested. Logging has taken its toll of the mature timber with the result that the more accessible areas have been cut out. Some of this cut-over land has been cleared; some has been burned and reburned to develop grazing units, but natural reproduction, from a few years in age to almost merchantable size, has come back. It is this intermingling of second growth timber and the grazing areas, coupled with the practice of burning to improve grazing, that makes this problem such a serious one from the protection standpoint.

The second growth timber has a definite value. It will be merchantable in a short time, and it is the potential timber crop that will soon be required to continue the industrial development of the Coos County area. The timber value of the forested area is far greater than its present value for grazing, and there can be no comparison in the amount of ultimate returns. It is largely this second growth timber that is threatened with destruction by fires through the development of grazing land, and it is the responsibility of the protection agencies to develop methods whereby the timber can be saved. This brief description gives a picture of the situation in practically all of this marginal area.

Suggestions have been made, and in good faith, too, that a line be drawn from north to south through this area—the line between Ranges 11 and 12 has been mentioned—with that area to the west devoted entirely to agriculture and

grazing, and that to the east to forestry. This suggestion also carried with it the recommendation that restrictions on burning, to a large extent, be lifted.

A brief glance at a cover map will prove the impossibility of such a procedure. The potential value of the second growth is too great to threaten its destruction through more or less uncontrolled burning.

There is no economic excuse or justification for sacrificing the large areas of second growth or for unnecessarily exposing them to a fire hazard through the development of grazing lands. They should be saved for a future crop. When that crop is removed is the time to settle definitely the question as to the future use of the land.

A few figures will illustrate the fire situation in southwestern Oregon during the past summer. The area lies largely within the boundaries of the district protected by the Coos County Fire Patrol Association, an organization administered by the Association and the State Forester. The total area patrolled consists of over a million acres, which includes all of Coos County, that part of Curry County lying north of the Sixes River, and a small strip of Western Douglas County. The fire record for the entire protective area during the past summer was 128 fires, which burned 139,368 acres and resulted in a loss of $1,642,858.

Now let us compare these losses with those that occurred in the marginal area located within the boundaries of the above association unit. On this area 109 fires burned 116,075 acres and caused a loss of $1,605,358. Thus 85 per cent of all fires, 83 per cent of the acreage, and 98 per cent of the loss were on the marginal lands. A further enlightening fact is that on this marginal area incendiarists were responsible for 61 per cent of the fires, 74 per cent of the acreage burned, and 99 per cent of the loss.

This serious fire loss is the result of the slow but definite growth of a fixed idea on the part of the livestock interests that forest protection is wrong, improperly administered, and works to the detriment of the various communities. There has been almost a total absence in most cases of any attempt to solve the problem. It is a public responsibility which the public has failed to accept for lack of funds properly to administer laws or to carry out cooperative agreements. Yet the problem is becoming more and more serious with the result that instead of being a voluntary project it becomes one that is forced upon the public and the agencies concerned.

Incendiarism is one of the stumbling blocks. The charge that improvement of grazing is the motive behind this illegal act is not my own. A prominent grazer recently made the statement to me that if satisfactory assistance in burning were given the grazing land owner there would be a drop of at least 80 per cent in the number of incendiary fires. The implication is obvious.

The incendiarist has no regard for property lines and very little for property values. If the implication in the grazer's statement is correct, the objective is to clean up the land and then graze it, usually without regard to ownership.

Here is a definite example of a public responsibility—to apprehend the law violator. In this responsibility the public has failed, because funds are woefully inadequate to combat the menace, and public sentiment is such that in many cases it does not frown on the practice. At this point it should be explained that any statements which I might make relative to illegal acts on the part of individuals in this area are not intended and do not apply to the livestock interests as a whole, but only to those who ignore state laws and the rights of others. Many residents make every effort to conform to all state laws covering forest protection and burning, and definitely acknowledge

and realize their responsibilities in the use of fire.

Some believe that unregulated burning is proper and that forest protection as practiced at present is antagonistic to best land-use policies. This group, which is a small minority only of the population of the county and represents only a fraction of the taxable base or income, has created a situation which, unless remedied, will threaten the future industrial life of the community—the forests and the forest industries. Yet those dependent for their welfare upon continuous forest production have taken no steps, either individually or collectively, to stop this practice. Here again is an example of the failure of the public to accept its responsibilities.

Apparently this is a problem which will require individual treatment. It would involve the assignment to the area of men whose entire time would be devoted to the work, getting acquainted by making personal contacts with each grazer, actually inspecting the land in company with the owner, and formulating a plan agreeable to both whereby it will be possible to develop grazing with reasonable assurance that adjacent timber would be protected. The construction of fire lines, recommendations as to clearing and clearing methods, and time and method of burning would probably have to be considered. With closer cooperation of this nature, consisting of advice and actual assistance at the time of burning from wardens who are familiar with the use of fire, it would be possible in most cases to do the actual burning desired by the grazer without more than the normal hazard.

A serious obstacle to the development of a regional plan is the instability of land ownership. Until some owner, either public or private, gets hold of the land and dedicates it to a definite use—either forestry or grazing—the general application and success of any system will be doubtful. It is necessary to aim toward that end, but in the meantime the problem faces us, it is becoming more serious each year, and we must develop some system, even if temporary in character, that will ease the situation and be a guide for the development of a permanent policy.

My opinion is that good protection and good forestry practice demand closer contact with forest land owners who desire to devote their lands to uses other than primarily growing timber, and cooperation with them in every way possible in their burning activities. Regulations should confine such burning to the permittee's lands. Furthermore, public opinion should both demand and support strict law enforcement for violations and fixed responsibility in such activities.

Innumerable instances, to which any forester can testify, give definite proof of the possibility of carrying out burning activities, under supervision following necessary preparatory work, with a minimum of danger to adjoining property and at a very small cost. Such work can also be done in Coos County.

The settlement of this problem lies in closer cooperation; a mutual understanding of the controversial aspects of the situation; research in land use and zoning; definite plans of procedure in land clearing; understanding and acceptance, not only of individual but of public responsibility; and an increased personnel in the state department sufficient to allow proper assistance to be given in the removal of fire hazards, adequate supervision of all protection requirements, and the apprehension of fire law violators.

ADMINISTRATIVE SETUPS FOR STATE FORESTRY

By JOSEPH S. ILLICK

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In a previous issue of the JOURNAL Dr. Illick traced out the historical development of forestry activities in New York state. In the present article, which is based on five years of study, the various types of administrative setups for state forestry are described, and the difficulties and opportunities in state forest administration are defined. State forestry administration is in a state of flux. Dr. Illick's study should serve as a valuable basis for any proposed changes in state forest administration.

FORTY-TWO states now have some form of administrative setup for forestry. Most of these forestry setups began functioning from twenty to thirty-five years ago. In only one state, New York, has there been an unbroken development of forest administration for more than fifty years, and in several states forestry was established as a definite state function only within the last decade —in Florida and South Carolina in 1928, and in Arkansas in 1931. The decade 1900-1909 stands out conspicuously as the period of greatest activity on the part of states in establishing administrative units to handle their forestry affairs. During this one decade sixteen states started their forestry work in a formal way, and of these sixteen states, ten launched their forestry programs during the three years (1904-1906). By 1910 a total of twenty-five states had their forestry work moving forward under some form of administrative direction, and since then seventeen additional states have set it up in an official way by establishing administrative units in their governmental organization.

FORESTRY NOT A PART OF EARLY STATE GOVERNMENTS

In no state was forestry a part of the original plan of state government. None of the early state constitutions, codes, or laws contained administrative provisions for forestry. The state government of Virginia was in operation for almost 150 years before forestry became a part of it, and even now the headquarters of the State Forester is at the University of Virginia at Charlottesville—approximately seventy miles from the State Capitol at Richmond. Pennsylvania had her state government functioning for 119 years before 1895, when provisions were made for forestry by establishing a Division of Forestry in the Department of Agriculture. Almost forty years elapsed from the time Minnesota became a state until 1895 when the State Auditor was made State Forest Commissioner with authority to appoint a deputy as Chief Fire Warden. Even in the younger states, forestry was not given a place in their original governmental organization. Oklahoma, raised to the rank of a state in 1907, made her first provision for state forestry in 1925 by creating a State Forest Commission, and Arizona, the last state admitted into the Union (1912), has not yet set up any administrative agency in her state government to handle forestry matters. And it is not likely that any such step will be taken soon, for more than three-fourths of her forest land is now owned or controlled cooperatively by the federal government. The fact that forestry was not included in the original plan of any state government explains why it usually was affixed to some other state function and rarely functioned as a separate department, board, or commission. In the main, the

original position of forestry was subordinate, rarely independent, and in practically no case was it originally integrated with other conservation activities.

State Forest Administration Emerged Slowly

From the beginning state forest administration had to break its own ground and work out its own development. There were no precedents to lean on and no past performances to copy. In such fields as silviculture, forest mensuration, forest management, and forest utilization, considerable usable knowledge, based upon several centuries of forest practices in European countries, was available for consideration at the beginning of forestry activities in this country, but it was not so in the field of forest administration, for the whole administrative structure and functioning of European states, excepting perhaps the cantons of Switzerland, is entirely different from that of the United States. This condition explains, at least in part, why state forest administration emerged so slowly in most of the states. It was an unknown, unexplored, and untried field of state responsibility. No charted courses were available to help give it direction.

Administrative Setups the Outgrowth of Experimentation

Practically all of the administrative setups for state forestry—and there have been a total of approximately 150 of them during the past forty years in the forty-two states that now carry on forestry work—are the outgrowth of experimentation. None of them were set up originally in a finished or even a semi-finished form, and not one of the original administrative setups now is functioning in its original form. In some states there has been relatively little change, while in others change has been almost continuous. In several states there have been as many as four drastic administrative changes within a single decade, while in others, for example in New Hampshire, the forestry setup has remained fundamentally the same for more than a quarter of a century.

An understanding of the factors that brought about these changes, and an appraisal of the influences that resulted in a steady and progressive development of specific administrative forestry agencies, is an essential requirement in the charting of a safe course for the future of state forest administration. To trace the development of forest administration in each of the forty-two states that now carry on forestry work would be very interesting and unquestionably result in a better understanding of contemporary state forest administration. To do this, even briefly, would result in an extended treatise rather than a short article. For good reasons, such a comprehensive plan of presentation must be set aside in favor of a short article giving special consideration to the great diversity of existing administrative setups, and a discussion of a number of significant administrative trends that are rapidly becoming discernible and which will be strong factors in fashioning future programs for state forestry.

General Classification of Administrative Setups for State Forestry (1937)

The following tabulation, the data for which was collected during the past few years by the writer, classifies under four major headings all of the states that now carry on forestry work, and with the name of each state is listed the specific kind of administrative setup now in use:

I—States in Which Forestry Is Combined With Other Major State Functions.

A. Departments, boards, or commissions of conservation.

a. With boards or commissions.
1. Michigan (Commission of 7 members).
2. Minnesota (Commission of 5 members).
3. Wisconsin (Commission of 6 members).
4. West Virginia (Commission of 6 members).
5. Iowa (Commission of 6 members).
6. Louisiana (With general forestry governing board of 6 members).
7. Missouri (Commission of 4 members).[1]

b. Without boards or commissions.
1. New York.
2. Massachusetts.
3. Indiana (Conservation Dept. now under Dept. of Public Works).
4. Illinois.
5. Kentucky.

B. Departments, boards, or commissions of conservation and development.
1. New Jersey (Board of 8 members).
2. North Carolina (Board of 12 members).
3. Washington (Board of 5 members).
4. Vermont (Board of 3 members).
5. Virginia (Commission of 5 members).

C. Department of Agriculture and Conservation.
1. Rhode Island.

D. Department of Natural Resources.
1. California (Board of 7 members).

E. Forestry, Fish, and Game Commission.
1. Kansas (Commission of 4 members).

F. Park and Forest Commission.
1. Connecticut (Commission of 7 members).

G. Department of Forests and Waters.
1. Pennsylvania (Advisory commission of 5 members).

H. Department of Forestry and Geological Development.
1. Georgia (Commission of 7 members).

I. Forestry and Recreation Commission.
1. New Hampshire (Commission of 3 members).

II—States in Which Forestry Is Handled as a Separate Departmental State Function.

A. Administered by single executive.
1. Maine.

B. Administered by state boards or commissions.
1. Alabama (Commission of 7 members).
2. Arkansas (Commission of 5 members).
3. Delaware (Commission of 5 members).
4. Florida (Board of 5 members).
5. Mississippi (Commission of 9 members).
6. Oklahoma (Commission of 5 members).
7. Oregon (Board of 8 members).
8. South Carolina (Commission of 5 members).

C. Administered by boards, or commissions affiliated with state universities, colleges, or schools.
1. Maryland (Dept. of forestry functions under the general administration of the board of regents of the University of Maryland [9 members] and an advisory board of forestry [5 members]).
2. Nebraska (Conservation department of the conservation and survey division, University of Nebraska.[2]
3. Texas (Board of directors of Texas Agricultural and Mechanical College [9 members]).
4. North Dakota (Board of directors, North Dakota School of Forestry).

D. Forestry administered by board affiliated with state agricultural experiment station.
1. Ohio (Board of control of agricultural experiment station, 7 members).

III—States in Which Forestry Is Subordinate to Other Major State Functions.

A. Agriculture.

1. Tennessee (Advisory board of forest conservation, 7 members).

B. Board of land commissioners.

1. Colorado.
2. Idaho (In cooperation with state cooperative board of forestry, 12 members).
3. Montana.

IV—States With no Administrative Setup for Forestry.

1. Arizona[2]
2. Nevada
3. New Mexico[3]
4. South Dakota
5. Utah
6. Wyoming

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[1]Amendment to state constitution creating a conservation commission passed in 1936. It shall be self-enforcing and go into effect July 1, 1937.

[2]The regulatory work in forestry and the forestry development work in state parks and recreation grounds come under the supervision of the game, forestation, and parks commission of 5 members.

[3]State-owned forest lands administered by U. S. Forest Service under a cooperative agreement.

The foregoing tabulation classifies the forty-two states that now have administrative setups for forestry into three major groups which are shown graphically in Figure 1. Group I includes those states that handle their forests in combination with one or more other major state resources such as parks, preserves, refuges, lands and waters. These resources are frequently grouped under the administrative heading of "conservation". Twenty-four states now belong to this group, and the number is increasing steadily. Ever since 1910, when Louisiana established the first administrative setup under the heading of conservation, there has been a strong and sustained trend towards an administrative grouping of conservation activities. Group II includes those states in which forestry is set up as a separate state function, usually administered by a department, board, or commission. While these boards and commissions are unattached to other departments, they are sometimes affiliated with universities, colleges, schools, or experiment stations. At present this group of independent or semi-independent departments, boards, or commissions includes fourteen states. Group III comprises four states that still have their forestry work subordinate to other state functions, chiefly agriculture and land administration. At one time this group included the majority of states with forestry programs, but one after another of these states released forestry from its subordinate position and gave to it an independent administrative rank, or combined it with other closely related conservation activities. The present trend is definitely away from the subordinate placement of forestry in state government. Group IV includes the six states that at present have no administrative setups for forestry.

Great Diversity in Existing Administrative Setups

A study of the general classification of state forestry setups presented herewith shows an astonishing diversity of organization. It is difficult to find two states with similar setups. Even in adjoining states with similar physical, economic, and social conditions the administrative setups for forestry often have little in common with each other. They offer plenty of evidence of having grown up like "Topsy", and of having been added to at random like the barns, sheds, and shops of an old farm. Surely, the ad-

ministrative structures and machines used in state forestry today are not the outgrowth of thoughtful planning based on enduring principles of public administration. Instead, it is becoming more and more apparent that state forest administration as it exists today was beaten out on many different anvils, by the hammer and tongs of sectional feeling, state rivalries, personal prejudices, partisan politics, bold experimentation, and blind adventure. To these can be added other influencing factors such as the condition of the state treasury, the attitude of the governor and other state leaders, the effect of great catastrophes (forest fires, floods, etc.) on the public support of forestry, and the common desire just to be different. Lack of money also has been a strong retarding factor. Lack of a trained personnel acted as a powerful check for a time, and an important influencing factor, commonly overlooked, was a general lack of understanding of the objectives and purposes of forestry. Under such conditions it was often necessary to take some action or pursue some course, and then on the basis of subsequent observations and experiences, determine what was wise and and what was unwise. As an inevitable consequence of all these uncertain influencing factors working with, through, and against each other, state forest administration at times moved one way and then another way. Often it had to withstand the heat of controversy and conflict, and then do the best it could in an atmosphere of compromise.

Against all these diverting, entangling, and retarding influences, state forest administration has made considerable progress and is now ready to enlarge its functions and improve its services to the people who are supporting it. That administrative improvements are needed and that changes should be made is generally admitted, but when and how to make these adjustments remains an important problem. The cure is not in the throwing out of one administrative setup and replacing it with another, nor in just

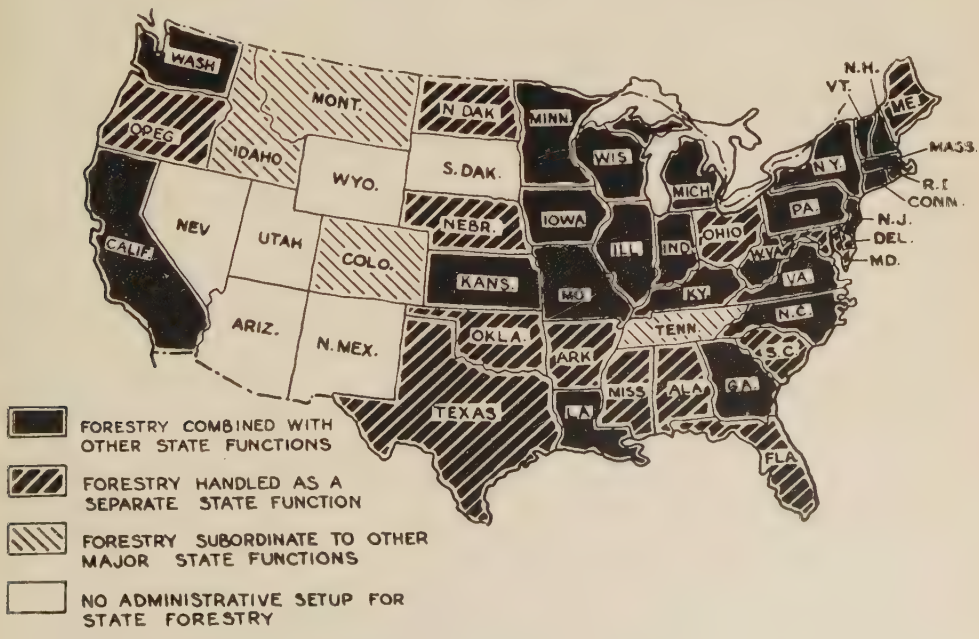


Fig. 1.—The general classification of administrative setups for state forestry in 1937.

trying one experimental setup after another. Administrative changes must be more than wasteful overthrows, adventurous experiments, weak compromises, pretentious platforms, or wishful dreams. To merely change the pattern of forest administration usually accomplishes little or nothing, and to operate before a thorough diagnosis has been made is often as fatal in forest administration as in human surgery.

Urgent Need for Administrative Studies

The time is here for foresters who have already assumed or are willing to undertake administrative responsibilities, to demonstrate their administrative competence. To do this effectively they must demonstrate competence not only in administrative matters as they are functioning today in the already broad and rapidly expanding field of forestry, but they must also assume the responsibility of directing such changes and improvements as will be necessary for the full future furtherance of forestry. The forest administrator of the future, irrespective of whether he will serve a federal, state, or some other public or private agency, must work persistently, unbiasedly, and knowingly towards planned objectives and give enlightened direction to the entire organization operating under his leadership. To do this well calls for the general qualifications usually required in administrative leadership, but there is one qualification that is often overlooked, and that is a thorough understanding of the principles and practices of administration itself. To become and remain an effective forest administrator one must first of all know administration, and not only as it pertains to forestry alone, but also as it operates in the broader field of conservation and the general field of public administration. To understand forest administration well, one's studies must not be limited to its present structures and functions but they must also give consideration to its past development, and if at all possible they must detect and evaluate significant administrative trends from which may be charted sound future courses of development. The writer, during the past five years, has set up and is now directing a series of studies in forest administration. It is practically a virgin field for study, and offers fruitful opportunities to those who are willing to help place forestry on a higher level of service to the people who support it.

THE REQUIREMENTS FOR AND EDUCATION OF A FORESTER[1]

By DAVID T. MASON[2]
Consulting Forester

No profession can rise much higher than the schools that train men for that profession. The discussion at the Annual Meeting of the Northwest Scientific Association is evidence of the broad and intense interest in the general subject of forest education. Educational problems are difficult problems for which there are no easy solutions. It seems clear that before solutions are found it will be necessary to deal with concrete evidence rather than with generalities. Nevertheless, the following summary gives a picture of at least one rather large and diversified group's conception of forest educational problems.

I HAVE been invited to digest and summarize the papers on forest education presented at the Annual Meeting of the Northwest Scientific Association by Elers Koch, Assistant Regional Forester, Forest Service, Missoula, Mont.; C. L. Billings, General Manager, Potlatch Forests, Lewiston, Idaho; Dr. E. E. Hubert, Research Forester, Western Pine Association, Portland, Oreg.; George Finlay Simmons, President, University of Montana, Missoula, Mont.; and Walter Mulford, Head, Division of Forestry, University of California, Berkeley, Calif.

In this broad, ever-widening field, it strikes me as rather surprising that, on the whole, there was such close agreement between the different speakers on the various phases of the subject. The papers gave a fine, broad discussion of this important subject. Evidently there is close agreement upon what the employer wants and what the schools wish to produce. Both want: first, men of character and intelligence; second, men broadly trained, with more emphasis than at present upon fundamentals as contrasted with the technical subjects, resulting in the production of an educated man; third, there is recognition of the need for apprenticeship to be provided by the employer after graduation.

Mr. Billings asks for men of vision to see opportunities and with courage to work for their realization. Mr. Koch wants men of intelligence, with character including confidence in themselves, courage, and the qualities of leadership. Someone has defined the qualities of leadership in a way which appears to cover fairly well what both Mr. Koch and Mr. Billings seek in their men. This definition states the qualities of leadership as consisting of the following ingredients—courage 50 per cent, initiative (including vision) 25 per cent, intelligence 15 per cent, and technical ability 10 per cent. These qualities, excepting technical ability, are largely inborn but they can be developed; therefore, the schools, recognizing the importance of these qualities, should definitely seek to develop them.

Mr. Koch points out that the men who entered the profession during the first decade of the century usually were of higher quality than the average of those who have come later and that, consequently, these earlier men have been more successful. Mr. Mulford indicates that these early men were better trained in the fundamentals but not so well trained technically as the later men; this may indicate that good training in the fundamentals is of more importance

[1]The individual papers summarized by Major Mason are being published in *Northwest Science* issued by the Northwest Scientific Association.—*Ed.*

[2]This paper is a summary and digest of papers presented at the Thirteenth Annual Meeting, Northwest Scientific Association, Spokane, Wash., December 29-30, 1936.

than good training in the technical subjects. Probably some additional elements tending to explain the greater success of the earlier men may be that the earlier men had more largely the valuable, helpful qualities which are found in the pioneer and which are the main essentials of leadership. Of course, also, these earlier men have had a greater length of time in which to become successful, and they have had the first opportunity to occupy positions of importance.

Simmons and Mulford raise questions as to how the quality of the students may be improved. Mr. Mulford points out that the University of California has adopted a policy which requires unusually high scholarship standards for admission to the forestry courses, which begin in the junior year. Similar high standards might well be applied to freshmen also. Mr. Simmons states that at the University of Montana the forestry courses are so difficult that only a small percentage of those entering as freshmen succeed in graduating. Possibly other effective means of improving the quality of the graduates would be by faculty advice to individual students who appear unsuited for forestry work; and by more definite efforts to attract to forestry courses men of unusual promise.

Simmons and Mulford discuss the progress of forestry education in this country, indicating that four periods may be recognized. During the first or early period fundamentals were emphasized relatively strongly, partly because there had not yet developed in this country a fund of information and experience upon which to draw substantially in the technical courses. In the second period, we find a strong reaction from the European forestry of the first period and, partly resulting from demands from employers, an over emphasis of the "practical", which often tended to make the forest schools more trade schools than professional schools. The third period is notable for the great diversity of courses offered in order to fit men for the many kinds of work in the extremely broad field of conservation. The fourth period is again one of reaction, this time back toward fundamentals, which the several speakers urge be emphasized far more strongly than has been done in the past.

Dr. Hubert and the others point out that, although for years employers wanted men of "practical" training who would immediately be useful in their work, employers now are becoming much broader minded and are seeking men of good fundamental training, with moderately good technical training, and with the expectation of furnishing the apprenticeship needs within the employer's own service. Undoubtedly, the more broad-minded and more far-seeing employers have the point of view just indicated, but it is feared that the majority of employers still have not yet risen above calling for the "practical" men. Education of most employers is desirable to develop a sound point of view in this respect.

The speakers generally agree that professional schools in order to turn out educated men broadly trained in the fundamentals must be satisfied to present a smaller number of forestry courses, each usually covered in less time than is customary at present. Also it is agreed that a minimum of five years of collegiate work is required, which even then does not pretend to produce specialists. As might be expected there is not agreement as to just how this may best be accomplished.

Mr. Mulford advocates a single basic curriculum with a certain amount of election permitted at the later stages. Others appear to favor separate curricula for a variety of main subjects, including perhaps all or many of the following: silviculture, logging, grazing, wildlife, and recreation. Another suggestion advocates

taking certain strong curricula already existing in a given institution, and adding to each certain forestry courses; for example, curricula in (a) commerce, (b) botany, (c) civil engineering, (d) chemical engineering, and (e) mechanical engineering, etc., might each be used as the foundation upon which to superimpose the training in forestry, giving a very little forestry work during each of the second, third, and fourth college years with a fifth year entirely devoted to forestry subjects.

Mr. Mulford points out that the forestry curriculum is an excellent vehicle for a good general college education, and that men having no intention of seeking a life work in forestry but desiring a broad general training, drilling them in looking far ahead, might well be encouraged to take forestry work.

The desirability of and necessity for strengthening the quality of the teaching work is emphasized by several speakers.

It is pointed out that for the training of specialists for any branch of forestry work, postgraduate study is absolutely essential. The more a student wishes to intensify his specialization in any given field, the more important it is that he have a broad fundamental training to support the specialization.

The employer has far more responsibility than has usually been recognized in the past. The employer should recognize clearly that the new graduate is not an experienced man and consequently requires a period of apprenticeship to learn the practical features of his particular employment before he can have the proper balance of technical training and practical experience qualifying him for reponsible work. There should be enough field work in college to make the courses clear, but not nearly enough to provide apprenticeship, which should come after graduation.

It is repeatedly emphasized that the Forest Service, which is one of the most important employers of forest school graduates, should revise its civil service examination with the purpose of encouraging education along the lines indicated above rather than, as in the past, requiring the memorizing of a great mass of miscellaneous facts, many of which have little or no place in the training desirable for the applicants.

Forest industries also should be strongly and repeatedly encouraged to seek men professionally trained along the lines indicated above and then to make definite arrangements for giving such men the required apprenticeship.

Young graduates should realize that the experience gained during the first five or ten years after graduation is of far more importance than the amount of the salary earned; consequently the young graduate should strive to find valuable experience rather than maximum salary. In this connection it is suggested that it is desirable, in order to secure breadth of view, that the men in the Forest Service before advancing to the higher administrative positions work part of their time in industry. For the same reason it is desirable that industry leaders have in their experience some period of public service.

Your commentator has never before had the pleasure of participating in such a broad, well founded discussion of forest education. He hopes that forest educators and employers, both public and private, will have and will take the opportunity to study this field of discussion through the papers presented by the men named in the first paragraph of this statement.

COMMENTS

By H. H. CHAPMAN

ON reading the report furnished by D. T. Mason on the discussion at the above meeting, it was my impression that those present very largely had missed the point, even though all but two western forest schools were represented.

In seeking some means of emphasis, I wondered how the arguments used would have sounded, coming from a medical gathering. It might read something like this:

"You have invited me to digest and summarize the papers on this subject previously presented by various speakers at the 2407th convention of the disciples of Aesculapius. In the broad and ever-widening field of medicine, under the impact of scientific discoveries and a new conception of human rights and dignity, I am pleased to note the unanimity of opinion which prevails as to what should constitute the training of a modern physician, so that he may become a worthy member of his profession.

"Evidently there is a close agreement on what the employer—the patient—wants, and what the schools wish to produce. Both want: first, men of character and intelligence; second, men broadly trained, with more emphasis than at present upon fundamentals as contrasted with skill and diagnostic ability, or the specific technical knowledge of the diseases in question, thus resulting in the production of a cultured man; third, there is recognition of the need for apprenticeship to be provided, by the patients, after graduation."

What is wrong with this picture? Merely the fact that professional education is left out. Let us admit, then, that we are not a profession—that in the 40 years of its development, forestry has failed to establish a body of professional knowledge which is essential to the forester, and let us forget this troublesome problem of further attempting to define what the scope of these fundamental professional requirements are, and let every school "do what is right in its own eyes", and thus develop freely to meet every wind of circumstance or pressure that may arise.

The argument that the earlier men who "were better grounded in the fundamentals" turned out better, does not square with my observations. In close association with every class in one school, since 1902, it is my positive opinion that the average quality and character of the men has not changed for the worse, but that the professional preparation they receive has become vastly better and continues to improve. These earlier graduates certainly did *not* get better training in the fundamentals by reason of the poor and embryonic quality of professional instruction dished out, but they wasted a lot of time that now is used more effectively. I would like to know what these fundamentals were that they got, that made them so good! Furthermore, just as many of these men fell by the wayside and dropped out of forestry. I think the mortality was even higher then than now. No, the success of the earlier men was that of pioneers, in a virgin field, where initiative, imagination, and personal integrity and common sense were the chief qualities needed. And this emphasis on fundamentals and character training, plus the acquisition of vocational knowledge from the employer after graduation, is merely a recognition that we as a profession are still in the pioneer stage.

The problem that we face, therefore, is whether we shall remain pioneers of the past or horse and buggy era of forestry, or become pioneers of the future or professional stage. The medical profession does not neglect emphasis on character and

intelligence, or the need of vocational training as interns (but under professional guidance). If by fundamentals we mean the slowly crystalizing principles and truths of forestry practice, in its several branches, emphatically we need them, in order to be foresters. If to these fundamentals we must add those in economics and culture (English, history, and classics) in addition to the basic grounding in science and mathematics, then let us look to the extension of the preparatory period and forget the 4-year course. If we are to be content to leave the major part of the special "adaptation" training to the employer after graduation, it will of course simplify our problem of specialized curricula, especially in lumbering, and in forest administration. There is no criticism of this idea. The vocational adaptations should follow the basic professional training and the only question is whether "you tell 'em" or they tell you. The former option requires special training, as in medicine, superimposed, however, on the basic professional courses, and not merely on cultural or scientific fundamentals. The latter means a period of subordination, absorption, and adjustment to the business setup, after which the opportunity comes to apply the professional principles and knowledge intelligently to the problems of the business. As to the four stages of evolution of forestry, I should prefer to describe them as: first, a blind groping for a body of professional knowledge, with consequent tendency to borrow, to a certain extent, "principles" from established European practice; second, a rapid development of a flood of new knowledge of technical practices, through the growth of public forestry, national and state, and of all its accessories such as fire protection; third, real progress towards shaking down this mass of data into well organized professional instruction, a process which has been rudely disturbed and interrupted by our explosively rapid expansion of public and professional activities to cover all other forms and phases of land conservation such as wildlife, erosion, parks (emphasized as a most outstanding form of conservation), etc. The fourth stage is ahead. It will, I hope, be one of "reaction". But when the tide retreats, it is my fervent hope that it will not be the fundamentals of professional forestry instruction that will be left stranded for the seagulls, but that in the broader sweep of the current we may hold fast our gains, consolidate our basic professional training, and on this foundation, as opportunity permits, advance in the line of more culture, better specialization, and proper allocation of vocational polish.

PASTURING WOODLAND IN RELATION TO SOUTHERN FORESTRY[1]

By W. G. WAHLENBERG
Southern Forest Experiment Station

This article touches upon the moot question of controlled light burning of longleaf pine forest lands to improve the range for wild game or domestic animals, and emphasizes the necessity for compromises, under the prevailing nonintensive development, where grazing may advantageously be combined with timber growing.

A STUDY of early history discloses a bitter conflict between the apparently peaceful pursuit of grazing and other land uses. The original forests of England vanished gradually in the 15th century under the subtly destructive influences of overgrazing by sheep. Apparently no one could prevent it, because the woolgrowers were powerful noblemen who controlled the government. Although in those days large-scale exploitation of timber had not begun, the heavily grazed forests in the Mediterranean countries were disappearing gradually. With the most fertile and best-watered lands in demand for agriculture, and with the grazing herds naturally occupying the dryer and more barren sites, the forest fell between the farms and the ranges, where it was subject to alternating encroachment by agriculture in moist periods and by grazing in dry periods. Apparently the natural extension of the forest never fully compensated for this shrinkage of forest area. In the mountains of France continued destructive grazing followed by erosion lowered the timber line by 1,000 feet during this same period. The restrictive measures of the 16th century followed the realization of the damage, but meanwhile long custom had secured vested "rights" for the stockmen. Centuries of experience had evolved the system of private ownership and control of farmland, but for a much longer period the forests and open range remained essentially unregulated common property, and the uncontrolled grazing industry continued to exist only at the expense of impaired productivity of both range and forest.

Although much of this decline in the productivity of the land is justly chargeable to mismanagement, some fundamental and universal conflicts in raising animal and tree crops on the same area should be recognized. Domestic animals often injure forests by browsing and trampling, whereas thrifty forest growth tends to reduce the food supply of the livestock. Grass and other forage plants occurring directly under trees are thinned and may eventually be killed out entirely. A complete stand of trees obviously leaves little room for minor vegetation. In like manner, a continuous sod cover may prevent forest reproduction. Shade from forest trees may be of some direct benefit to the animals, but not to the forage. For example, in Ohio, it was found[2] that woodland pasture was 22 per cent less nutrious than open pasture and that the yields were much lower. Conflicting interests are ever present wherever grazing and forestry are carried on together, but the conflict becomes more acute as either enterprise makes progress, thus necessitating compromising changes in manage-

[1]Address delivered before the pasture symposium, 38th annual convention of the Association of Southern Agricultural Workers at Nashville, Tenn., February 4, 1937.

[2]Welton, F. A. and V. H. Morris. Woodland pasture. Jour. For. 26:794-796.

ment. Ultimately, of course, the inevitable clash of interests may become so acute that compromise becomes impracticable, and any simultaneous intensive development of grazing and forestry over the same area becomes impossible. Complete separation which relegates trees to good timber sites and animals to improved pasture enclosures, therefore, will be advisable in increasing numbers of cases; but the feasibility of combining the two enterprises, in managing extensive tracts of land, is affected so largely by the degree of development of each enterprise that further consideration should be given to the various stages of development.

Under primitive conditions, this conflict may not reach a critical stage. For example, the early lumbermen in the South, unconcerned about the perpetuation of timber resources, welcomed the indiscriminate grazing and burning of their lands. These primitive activities not only contributed meat and hides to the livelihood of the community, but also helped to keep the woods green, open, park-like, and relatively easy to clear for agriculture. Thus the early relation between forest and grazing interests was actually harmonious, but only because both industries were undeveloped. This early harmony was a pioneer condition that ended definitely when the forest-conservation movement appeared.

A somewhat less primitive, but no less temporary, stage of development now prevails in the South, although the practice of both forestry and grazing is still relatively crude, and segregation is practicable only on limited areas. A large portion, perhaps two-thirds, of the commercial forest area is being grazed, the permanent pastures so far established being insufficient for present needs. Yearlong open-range grazing is not recommended, but the practice continues over large areas. Although forest and forage cannot develop fully on the same spots, they are closely associated in a mosaic over large areas in the South. While this prevalent condition precludes full crops of timber, it fortunately permits the forest to support larger numbers of wild game and domestic animals. Removal of virgin timber stimulates forage production to a degree impossible to maintain as existing second-growth forests mature, and as many stands now understocked with trees are rehabilitated by conservative treatment. Thus, although the present conditions represent a temporary stage of development and one in which fundamental conflicts may appear, integrated forest and grazing management is nevertheless quite feasible and desirable.

Before discussing this subject further as it affects the "deep South," it would be well to mention briefly how the situation in the Southwest compares, and that of the Central States contrasts, with that in the South. But first let me review some of the specific effects of grazing on forests.

Effect of Forest Grazing on Tree Seedlings

In many forest regions, grazing has a profound effect on the regeneration processes in forests. Sometimes the effect is beneficial, as for instance, the exposure of mineral soil by sharp-hoofed animals, making way for the effective germination of seeds where heavy litter has prevented, or retarded, forest reproduction. In this way, and because they eat acorns, hogs favor the reproduction of shortleaf pines where they grow in mixture with the oaks. When browsing is necessary for sustenance, hardwood browse is preferred by most animals. Thus coniferous growth is favored in mixtures of pine and hardwood. Selective browsing in mixed hardwood stands may be advantageous or otherwise, according to the relative timber value of the more palatable species.

More often, however, grazing is clearly

detrimental to the forest. In mixed hardwoods heavy browsing commonly increases the percentage of inferior species in the succeeding stands of second growth; and where the species composition of the forest is not adversely affected, the density of stands may be lowered enough to reduce seriously the quality of products and the quantity of profits.

Naturally the degree of damage to range or forest varies with the degree of overstocking with game or domestic animals.

The class of livestock is likewise important. Cattle and horses usually do much less harm than sheep or goats. This is because the cattle and horses naturally range over a wider area in less dense formation; they prefer to avoid the steep slopes; and they browse less. The smaller animals, especially goats, browse many more species, and consume the vegetation more completely, thus damaging more plants beyond recovery.

Other Effects of Forest Grazing

The number of fires in the woods of the South is increased by stockmen, who have long used this means of increasing the availability of early spring forage. Also frequent fires increase soil erosion in areas subject to this menace. On the other hand, both the fire hazard and the severity of the burns may be reduced by grazing practices. This reduction may result from the direct consumption of combustible materials on areas heavily stocked with animals—usually enclosures —or it may result from the burning of these materials by frequent grass fires, as on the primitive open ranges.

Another effect of heavy grazing is a change in the character of the surface layer of soil, even where no erosion is involved. To a certain extent, soil fertility may be increased by grazing animals as a result of mixing forest litter with mineral soil and manure. But trampling by livestock renders the surface layers of soil more compact and less easily penetrated by rain, insects, or roots. Thus deterioration in the physical condition of the soil may offset any increased fertility resulting from grazing.

While small tree seedlings suffer critically from all these adverse conditions, the larger and older trees are not always immune to injury. Although relatively thick bark protects them from the less severe fires, and most of their foliage is out of the reach of browsing animals, many large trees suffer cumulative ill effects indirectly due to grazing. Shallow-rooted species are particularly susceptible to injury from surface-packed or surface-eroded soil. Growth is reduced and vitality is lowered, as indicated by increasing stag-headedness. Such weakened trees are the ones that succumb most easily to insects, fire, disease, and wind.

Situation in the Central and Southwestern States

In commercially valuable farm woodlands of the Central States, particularly the hardwoods of the Corn Belt, grazing appears to be incompatible with continuous forest management. Reproduction is destroyed, growth reduced, and the producing power or quality of the site seriously impaired. Heavy grazing continued over many years has gradually opened the canopy of many forest stands, resulting first in the loss of the understory of forest vegetation and its gradual replacement with a complete ground cover of sod that prevents regeneration of the forest. If this sort of forest deterioration is arrested in its early stages by the exclusion of livestock, the forest may recuperate promptly enough, but studies have shown that natural recovery from the later stages of such forest decadence are either slow and uncertain or entirely hopeless. Furthermore, the present forest-grazing practice seems to fail to maintain either the woodland pastures or the animals themselves. Carrying capacities are

being lowered through the gradual elimination of the better forage plants, and studies have shown that without supplementary feeding animals allowed up to 6 acres of woodland pasture per head still lose weight; the forage is insufficient to maintain the animals satisfactorily for 6 months. Under such circumstances, the grazing of these woodlands cannot be recommended.

Although more favorable conditions for grazing prevail at present in the ponderosa pine (*Pinus ponderosa,* Laws.) forests of the Southwest, there are few regions in which grazing may effect the forest so vitally as here, owing to the long intervals between years of good reproduction and to the fact that seedlings, which grow slowly in youth, are commonly browsed until the terminal shoots extend beyond reach of livestock. It is not unusual for large steers to remove the leader from a sapling 6 feet tall. Seedlings are most susceptible to injury when less than 3 years old. Under heavy grazing, practically an entire stand of seedlings in their first or second years may be destroyed by browsing, but after their second year, young pines gradually develop recuperative powers that are truly amazing. Nevertheless, repeated browsing may kill or permanently deform seedlings 2 feet tall. Damage by grazing has decreased greatly since 1927, mainly as a result of heavy reduction in the number of livestock, associated with the fact that survivors of an extraordinary seedling crop originating in 1919 had by this time passed the stage of greatest susceptibility. Reducing the numbers to the carrying capacity of the range is beneficial, but is not always adequate; it may even become necessary to remove completely the offending class of stock during critical periods. If small seedlings are being browsed, they should receive complete protection until 2, or preferably 3, years old. After that it is usually sufficient to keep stock out for a month in early summer, when grasses usually dry up and pine terminals are growing, and again, perhaps, late in the fall after the grasses have been killed by frost. Concentration of livestock around watering places, on trails, and on bed-grounds should obviously be avoided as far as possible. Constructive measures are: correct stocking, adequate distribution of water, proper use of salt, and avoiding repeated use of the same bed-ground for sheep. Grazing under proper control, however, may be an aid in the reproduction of pine and in the reduction of danger from fires by curbing an over-luxuriant growth of herbaceous vegetation.

Southern Range Land and Range Animals

Southern forest ranges are not as well known as those of the semi-arid West; nevertheless, about 200 million acres of forest area in the South[3] provide some grazing for livestock. Most of this is unimproved open-range; probably less than a quarter of it is enclosed by fences, and scarcely a tenth of the area is improved pasture.

The region contains over 18 million head of domestic stock—14 per cent of the total number and 11 per cent of the value for the United States as a whole.[4] With the exception of mules, the proportionate number exceeds the proportionate value for all classes of stock, indicating the inferior quality of the southern animals, which are mostly in small herds owned by numerous farmers, who do not

[3]Includes nine states from Virginia to Louisiana and Arkansas and adjacent parts of eastern Oklahoma and Texas.

[4]Statistics from the 1934 agricultural census. See also Southern Forest Ranges, in appendix of The Western Range, Forest Service, U. S. Dept. Agric. Senate Document 199, 1936.

possess sufficient range or pasture to support them adequately. It may be mentioned in passing that the great majority of southern stockmen do not own the range on which they depend for forage. Under these circumstances, the uncontrolled use of fire on the range may benefit certain stockmen, but at the same time it often is detrimental to the interests of the timber land owners. At its best, southern grazing is thus seen to be a primitive and underdeveloped enterprise which is nevertheless of great importance to the local people.

Longleaf pine (*Pinus palustris*, Mill), more than the other southern pines, originally stood in extensive even-aged stands, which in later years were cut relatively clean. The early custom of annual burning and open-range cattle grazing was continued after the major lumbering operations ceased. Although a great deal of the original area has now grown up to slash and loblolly pines and various oaks, large areas still remain for grazing. The grazing of southern forest ranges cannot be considered apart from the problem of woods-burning.

An Experiment in Southern Mississippi

An experiment was established in southern Mississippi in 1923 to determine the effect of typical woods-burning procedures on the cattle and the forest. The experimental tract contained a residue of about ten trees per acre from the original longleaf-pine stand, patches of thrifty advanced reproduction, and open areas where reproduction was incomplete and native forage plentiful. After fencing out the hogs from a half section of this cutover land, 160 acres were protected from fire, and 160 acres were burned over each year. The woods pastures were grazed for equal periods of about 9 months each year, and stocked alike with an allowance of 10 acres per steer for the first 5 years, then 5 acres for 1 year, 7½ acres for 3 years, and then again 10 acres per head, a restoration of the original stocking. Two 10-acre ungrazed plots were reserved as a check, one of which was burned annually, the other left unburned.

With the exception of 1 year only, cattle on the burned area showed consistently the better gains. Over a period of 11 years, the average gain in weight of the cattle was 69 pounds per head and grazing season on the unburned pasture as against 101 pounds on the burned pasture, or a difference of 32 pounds. Of this advantage 26 pounds, or 81 per cent, were gained before June and held for the rest of the season.

Neither of the two dominant native grasses (*Andropogon scoparius* Michx. and *A. tener* (Nees) Kunth) supply good forage except in the spring. Both of them, but especially *A. tener*, the one preferred by cattle, were thinned out severely by the smothering effect of dead vegetation accumulated under fire protection, whereas original proportions and density of native grass stands were more nearly maintained on the burn. Patches of the relatively very palatable carpet-grass (*Axonopus compressus* (Swartz) Beauv.) occurred over equally small areas along old roads in both pastures. Though as yet insufficient in quantity to be of economic importance on this area, its known quality and prospective value should be emphasized. Well acclimated, except for occasional die-back from frost or drought, this introduced grass of prostrate habit was found to thrive under the concentrated grazing of cattle and to extend its area gradually in competition with the native grasses. On the pastures this was true regardless of burning treatment, because the cattle did not leave enough of this grass to burn at all. On the ungrazed check plots the previously well-established patches of carpet grass were crowded back by the rank growth of native grass, whether burned over or not. As carpet-grass range will support five

or ten times as many head of stock as comparable areas of native range, its growth should be encouraged. Also it is possible that grazed carpet-grass fire-lines may be found useful in forestry operations.

On native range the well known preference of livestock for the fresh green grass of burns has been attributed to freedom from the admixture of dead fibrous grass, which they must consume with the green grass on unburned areas. The inferior nutrient quality of the grass on unburned areas may also be involved in this preference, since analysis indicated less protein, lime, and phosphorous in green grass from the unburned pasture. The total bulk of grass was, of course, much greater on the unburned pasture because of the accumulation of dead material, but the green or living portion was tall and spindling weighing only half as much per unit of area as the grass from the adjacent burn. The greater amount of the annual grass crop on burns may be due in part to an earlier spring start induced by warmer soil; 3 inches under the blackened surface of the burn temperatures were found to be 1° to 6° F. higher than off the burn. Furthermore, soil organic matter and soil nitrogen content were found to be slightly less on the unburned land. The apparent decline in organic matter as a result of excluding fires is associated with a reduction in the bulk of grass roots in the soil, and the similar decline in soil nitrogen possibly may be connected with an observed decrease in the stand of legumes on the unburned pasture.

While excluding fires caused a slight decline in the desirable chemical properties of the soil, it seemed to have the opposite effect on physical properties. The surface soil became softer, less compact, and more penetrable where fire was excluded. Grazing alone hardened the surface soil much as did burning. The tendency toward compactness was manifest in numerous measurements. Where cattle congregated, as on patches of carpet grass, the least penetrable soil was found.

Longleaf pine seeds germinated well enough, but all were killed within a year by further trampling and grazing on all of the small patches of carpet grass, since they were invariably cropped very closely by the cattle. On the much more extensive areas of native grass, similar, but less complete, losses of yearling pines occurred only as a result of overstocking (one steer to 5 acres in 1928). Fires are also most fatal to seedlings during their first year. In a single year the survivors may or may not be numerous enough to regenerate the forest. After the first fire, survival of 3-month-old seedlings from the seed crop of 1924 was 67 per cent (or 9,000 per acre) grazed, and 31 per cent (or 5,000 per acre) ungrazed, apparently enough for a new crop. A similar burning treatment used on the 1927 crop, however, killed 90 per cent outright, leaving only 146 per acre grazed and 49 per acre ungrazed. Unconsumed forage on the protected areas apparently added to the heat of the fires.

Longleaf pine seedlings more than a year old were sometimes completely defoliated, but rarely killed, as a result of a single fire. No direct or measurable injury from grazing was apparent. As soon as the typical luxuriant plume of foliage was formed on older seedlings preparatory to height growth, the longleaf pines were avoided by cattle. Within the limits of the carrying capacity of the native range for cattle, browsing damage to longleaf pine need not be feared.

In stands of longleaf pine saplings, the occurrence of frequent uncontrolled winter fires commonly reduces diameter growth about 20 per cent and height growth about 25 per cent. This amount of retardation can be greatly diminished by properly controlling the intensity of fires used for cultural purposes.

It is doubtful if heavy thinnings of second-growth timber merely to prolong the life of the forest range in the South can be justified. Thinnings made in young timber to increase naval stores yield may improve grazing, but forests kept open enough to maintain the forage produce rough timber of low value for lumber.

Regulation of Grazing in Forest Management

Damage to forests by livestock may be regulated by restricting the activity of the animals or reduced to a minimum by excluding them entirely.

Exclusion by segregation on suitable enclosed pastures is recommended where damage is severe as in hardwood forests of the Central States. Where less damage is done, as in the pine forests of the South, complete exclusion may also be advisable in intensively developed woodlands well stocked with trees. More often, regulation by *partial* exclusion or by discrimination against certain classes of stock is sufficient; for example, range hogs should be kept out of longleaf-pine reproduction until the seedlings are well out of the grass.

Grazing of forests also may be restricted to a certain time and place. In the South the native grasses are nutritious only about three months in the spring; hence the stock may be removed from woodlands in midsummer if other range or pasture is available. Under most systems of forest management, reproduction of the trees is confined to areas recently cut over. On such restricted areas, the control of grazing is very desirable during the regeneration period of several years. Heavy grazing before seedfall should be followed, if possible, by exclusion of animals until the new tree crop is established; it may then be resumed for a time if there is still sufficient forage growth. Unfortunately, the execution of such well timed and properly localized control of grazing is often prevented by the high cost of necessary herding or fencing, but the occurrence of such prohibitive costs may be expected less often in the future as more projects become profitable through intelligent management of all resources. Increased profits from raising livestock are possible in the South where the urban markets, now dominated by western meats, are willing to accept high grade local meats, which can be produced, as has been demonstrated by some of the southern agricultural experiment stations.

When the major portion of a forest property has been heavily cut over, 20 or 30 years may elapse before any income becomes available from forest products. Such heavy cutting is not to be recommended, but if made, possible profits from grazing may be available for carrying charges on the forest land, and such a source of income may be indeed welcome until the productivity of the forest land can be restored.

Conclusion

In attempting to share the same land areas the fundamental needs of the forest and grazing industries inevitably conflict. Furthermore, it is natural for the interests of the two enterprises to clash with increasing severity as the use of land becomes more intensive, and ultimately occupancy of the same land by forest and grazing interests clearly will be impossible. Until then, however, and that means for some time to come, land owners may well seek a compromise in land management designed to add an income from wild game or domestic animals to that obtainable from forest products. In "dual-use" projects without intensive developments, the yield of either product may not be large, but the combined income from the animals and the trees together may often bring highly profitable economic returns.

THE IMPORTANCE OF PRIVATE FORESTRY[1]

By PAUL R. KEVIN

U. S. Forest Service

The practice of private forestry in the United States is far from an accomplished fact. In certain quarters, however, encouraging progress seems to have been made. In the following article Mr. Kevin gives a clear-cut picture of the status of private forestry in the pine region of California. This presentation is detached, judicial, and free from adulation or rancor. Some readers will, no doubt, consider the situation described by Mr. Kevin encouraging; others may consider it discouraging. In any event, it will be found well worth while reading.

Following Mr. Kevin's paper will be found a brief discussion of it by Walker B. Tilley of the Western Pine Association. This discussion also will be found to be of interest.

FIFTEEN years ago, when I began to take a serious interest in forestry, a rough and ready description of a forester's job was "the art or science of raising timber as a crop." While this definition has been broadened considerably in recent years to cover a variety of activities pertaining to land use, "timber as a crop" is still the keystone. The word "crop" in the sense used here carries two coactive implications: first, arrangements for repetition of the harvest, and, second cultivation. Accordingly, the timber operator is practicing forestry if he takes sufficient action to prepare for the production of a second harvest, and then protects and increases that crop to the best of his ability. The quality of the forestry practiced is determined by the volume and the value of the commodity produced.

Private forestry practice has been actively discussed for years, particularly since the Lumber Code came into existence. There seems to be no particular objection to its desirability, but the ways and means to achieve it are open to question.

The primary object of this paper is to give a rough and, necessarily, somewhat blurred picture of the sawtimber situation, with particular reference to the pine region, as it exists in California today.

In the course of our work during the past year or so we have been attempting to divide the merchantable timber areas of the pine region into so-called working units. Two principal factors entered into the determination of the boundaries; first, topography, because the timber included in a unit should be physically accessible to a central manufacturing plant, and secondly, the timber type, because stands near the proposed exterior limits, consisting of more than 50 per cent by volume of fir species, were excluded. Other considerations, such as brushfields, ownership, location of cut-over lands, and, on operating areas, capacity of the present mill installation, played a smaller part. Volumes were tabulated from available cruise data, both Forest Service and private, by ownership and species. Such summaries have been completed for 24 units, with management plan data available on 9 additional units. Information on the remaining units has been compiled from current National Forest timber policy statements. Several areas, on which the virgin timber has been practically ex-

[1]Presented at the annual meeting of the California Section, Society of American Foresters, January 8, 1937.

hausted, have not been considered in our calculations, as the volume remaining would have little effect on the general total.

The net result is 80 tentative working units, 12 of which need not be considered here, as they are either restricted to local use, are already cut over, or are in the fir type. This leaves 68 units of importance from which the sawtimber of the pine region will be produced during the next few decades. The available volume per unit ranges from 150 million board feet on the smallest to over 5 billion on the largest, with the average stand about 1½ billion. This does not mean that pine operations in the state will be confined to 68 mills. There may be more, or less; some of the smaller areas can be combined to supply one mill, and the larger areas may be split up to accommodate several mills. The setup can be influenced by so many factors that no attempt will be made at prediction.

Twenty-eight, or 41 per cent of the units, but only 31.5 per cent of the total volume, are classed as under government control, because over 75 per cent of the volume of each is on National Forest land. Mills are established on six of these twenty-eight units. As all operations under this classification will be handled under standard Forest Service practices, they need not be considered further at present. The bulk of the timber concerned is below average in quality or presents a difficult logging chance, or both. Of the twenty-two nonoperating units, only three or four have prospects for development within the next ten years.

Forty units are regarded as being under private control, i.e., 25 per cent or more of the timber, usually the most accessible and best, is owned either by an operating or holding company. Government timber ranges from 5 to 75 per cent and averages about 43 per cent. Sawmills are established on eighteen of these units, and twenty-two are classed as nonoperating, disregarding, in all cases, the small mills of low annual production.

The total volume included in the 68 units is slightly over 100 billion board feet. Breaking down this 100 billion board feet, to use a round number so that the percentage figure will also represent billions of feet, according to the previous segregation, it is found that 68 per cent of the volume occurs on privately controlled units, 29 per cent on 18 operating units, and 39 per cent on 22 nonoperating units; and 32 per cent on 28 government controlled units, 11 per cent on 6 operating units, and 21 per cent on 22 nonoperating units.

At first glance it seems that the practice of private forestry is of immediate importance on the 29 to 30 billion board feet of timber on the privately controlled operating areas, and when it is considered that about 41 per cent of that volume is in government ownership, the remaining 17½ to 18 billion feet does not loom very large. Nevertheless, it is nearly one-fifth of the total available volume, and the methods applied to its development will materially affect the additional 22 per cent of the privately owned timber on the nonoperating units. The latter figure is derived from a total volume of 39 billion, of which 44 per cent is on National Forest land. Private ownership, exclusive of that on government controlled units, therefore affects 40 per cent of the available sawtimber volume.

General figures of this type usually are not very impressive, but perhaps they can be approached from another angle. The average annual cut of the mills producing 5 million or more board feet per year on the privately controlled operating units is between 750 and 800 million board feet. If the cut were to be confined to the private timber on those areas, the raw material would be exhausted in less than 25 years. If this drain were increased by the estimated 50 per cent of

the annual cut per year, because of losses from fire, insects, disease, and other causes, the maximum average life of present operations would be 16 years. The relationship to the totals still holds true, as this period is also about one-fifth of the expected life of operations for the total available sawtimber volume.

Other interesting figures may be obtained by considering all pine mills in the state with an annual production of 5 million board feet per year or more. There are about 32 such mills with an average total annual output of approximately one billion feet. They fall roughly into three groups: the first, composed of about 15 plants own very little timber but depend on obtaining their raw material from other owners, federal or private, either by outright purchase or by cutting agreements extending over various periods of time. This division supplies about 30 per cent of the total average annual output. The second group, 7 mills, producing 20 per cent of the annual cut, own less than enough timber to supply their needs for ten years. The last group, 10 mills, own sufficient timber to operate at their present rate for more than 10 years, and they produce 50 per cent of the annual cut. To repeat, 50 per cent of the average annual cut is produced largely from company owned lands, 20 per cent from combined company-owned and purchased timber, and 30 per cent mostly from purchased timber.

Before proceeding further along this line of analysis, it seems advisable to bring up the rather touchy subject of sustained yield. This term has been used so often and so loosely that nearly every individual has his own interpretation for it. As applied to forestry practice its literal meaning is the removal each year from a given area of a volume of timber equal to the net annual growth on that area. What is not commonly appreciated is that sustained yield is an ultimate objective which in this region cannot be attained in a short span of years. About the earliest it can be expected, starting with virgin timber, is sometime after the first rotation, which may be anywhere from 100 to 150 years after the first cut. Even on federally controlled areas under management, the immediate objective is to place the land in the best practical condition for producing a new crop of timber with considerable weight given to the problem of maintaining a continuous supply of raw material for the manufacturing plant or plants concerned. At present this is accomplished by leaving approximately 20 per cent of the volume for insurance, seed production, and a second cut. In almost all cases this second cut is expected to be from 25 to 50 per cent lower per year than the first. This is not sustained yield in the literal sense, but it is the first and longest step in that direction. Two cuts to a rotation are suggested because this is the current practice. Theoretically, two or three successive cuts which would remove the last of the virgin timber on the unit at about the time the new crop reaches maturity would be satisfactory if an even-aged stand is the final objective. If a continuous uneven-aged stand is desired, numerous light cuttings are almost compulsory.

The advantages resulting from sustained yield, or the maintenance of a continuous supply of raw material, are many but the principal ones can be boiled down to one word, stabilization. Of interest to the general public is stabilization of community income, a stabilized source of employment, a stabilized tax base, and stabilization of other resources, such as recreation, fish and game, water flow, etc. Of interest to the timber operator is stabilized lumber production, and the resulting stabilized lumber prices, stabilized mill maintenance and depreciation, stabilized labor supply, and of course, a stabilized tax ratio. The disadvantages refer principally not to the objective itself but to the existing setup,

which includes not only physical equipment but also such items as taxation methods and the credit situation.

It has been stated that 50 per cent of the average annual output was produced by mills controlling more than ten years' supply of raw material. One-fourth of this amount, or 12 per cent of the total cut, comes from mills definitely planning on a continuous timber supply. A continuous timber supply is nearly impossible for mills furnishing the other 38 per cent of the cut because of the plant size and its consequent financial obligation, insufficient volume of timber, or excessive carrying charges on timber. The first two reasons apply to the majority of the second group. Lack of controlled timber volume is the chief impediment to the group operating largely in purchased timber. Stated another way, and this is an approximation because of insufficient data, and again using the average annual cut of mills producing 5 million or more board feet per year as a basis; 20 per cent of the total cut is from areas under formal or informal management plans, 15 per cent from plants which control insufficient timber at present but for which there is an available supply for a continuous cut with a small reduction in output, 45 per cent from operators with relatively large timber holdings but necessitating a heavy reduction in cut for continuous production, and finally, 20 per cent from mills with little available timber left. In other words, management for a continuous supply of timber is in effect for 20 per cent of the annual cut, possible for 15 per cent, improbable for 45 per cent, and impossible for 20 per cent.

Since sustained yield is a long time objective, and since very few of the present timber operators are in a position, financial or otherwise, to look forward to its culmination, the chief problem of private forestry practice now is to leave the land in productive condition for future operators. The most important step toward that end seems to be selective cutting. There are two types of selection, silvicultural and economic. These are sometimes conflicting, particularly with reference to the so-called inferior species, but it is believed that they are practically synonymous when applied to the principal commercial species.

Considerable work has been done in recent years in an attempt to determine various economic limits as applied to tree selection, and it is almost certain that a workable method that can be applied to standing timber will be available in the very near future. Once it is proven, and it is believed that it is now possible to do so, that it is to the operator's advantage not to cut timber below the economic diameter determined for his particular area, the greater part of the problem will be overcome. One difficulty that arises in operating on stumpage purchased on a footage basis is that all merchantable timber above a certain minimum diameter breast height must be paid for, and usually that diameter is below the economic limit, but even here it would be to the operator's advantage if he would leave those trees standing which are below the economic limit. To be sure, he would have to pay for their contents, but he would not incur extra logging expenses which cannot be met by the value of the product.

After the trees to be cut have been selected, the next necessity, from a forestry standpoint, is to protect the remaining stand, including the advance reproduction, from mechanical injury resulting from felling or skidding, and from loss or damage from fire, insects and disease. This protection is really subject to more argument as to ways, means, responsibilities, and so forth, than selective cutting itself, but this does not fall within the scope of the present discussion. The requirements of our previous definition of the practice of private forestry, "al-

lowing for a second cut and protecting it," will be met if the preceding suggestions are carried out.

No reference has been made to the timberlands already cut over. The available data give the area of second growth as 1,200,000 acres, and of restocking land as 1,800,000 acres. It is estimated that in seventy years these areas will have a stand of about 50 billion board feet. But several areas classified as second growth are being logged at present, and it is believed that the balance will serve at least to bridge the gap between the first and second cuts of the present virgin stand.

To recapitulate, 40 per cent of the most accessible and best quality virgin timber in the pine region is in private ownership, nearly one-half of which, or 18 per cent of the total, is being operated at present; the total average annual cut of the larger mills is about one billion board feet a year, only 20 to 35 per cent of which can be economically handled by present establishments under management plans directed toward a continuous supply of raw materials; the practice of private forestry on the remaining operating areas and those contemplated for the future is not only desirable but economically feasible; arguments against the practice of private forestry are not against the theory or ideal, but relate to the obstacles —physical, financial, or psychological— to be overcome before that practice can be definitely established.

COMMENTS ON MR. KEVIN'S PAPER

By Walker B. Tilley
Western Pine Association

MR. KEVIN is to be congratulated on the excellence of his paper, which gives a very enlightening and interesting quantitative analysis of the pine timber resources in the principal pine regions of California. It is encouraging to note his common sense approach and attitude towards the ultimate objective of both private and public forest owners, i.e., the continuous production of profitable forest crops on forest lands suited to that purpose.

He correctly infers that the long road to this ultimate objective is beset with many obstacles and that final achievement depends on solving the many problems those obstacles present—a process which will require several generations.

The stewardship of forest lands — whether they be operating or nonoperating, implies forest management. This in turn implies some degree of forestry practice. In the case of nonoperating properties the degree of forestry practiced may be restricted to protection from fire, disease, and insects. The degree of forestry practice or forest management essential to an operating forest property may vary somewhat, but the importance of its practice is increased many fold. Added to the normal destructive agencies of fire, insects, and diseases are such problems as: (1) destruction of residual timber values, (2) destruction of advance growth, (3) destruction of soil values, and (4) additional fire hazard.

It is quite generally recognized that protection of virgin timber stands is a forest practice essential to the survival of a forest products industry.

It is not so generally recognized that leaving a nucleus of young timber and advance reproduction and protecting it from destructive agencies is also essential to the survival of a pine forest products industry. This is absolutely essential in any pine forest area where there is possibility of sustained production. It also

holds true even in forest areas where there is little possibility of keeping existing plants in continuous production. The fact that present operating facilities will exhaust the forest before young stands are ready for harvest removes neither the desirability nor the necessity of good forest practice. Reasonable care to preserve values is an obligation of ownership—especially of a fundamental and basic resource like land. The greatest difference in the degree of forestry practiced will be the quantity and quality of residual stand left on the area.

The determination of quantity and quality (or volume and value) of timber to be harvested during the present cutting cycle is a most important consideration. One of the first essentials of management is to make a comprehensive study of the fundamental facts relating to the enterprise to be undertaken. Without such a study intelligent management is impossible. It has long been the practice in the forest products industry to be satisfied with very meager data on the quantity and quality of raw material available. Recently there has been made available much information which indicates clearly that only certain sizes and qualities of timber can be economically harvested for the manufacture of lumber. It has also clearly been shown that both the quantity and quality of trees that can be economically harvested are variables which change constantly with changing conditions of location, cost, nature of plant and equipment, demand, and many other factors.

Without detailed basic information relative to the raw material supply and the intelligent analysis of such data, and its bearing on the operating and marketing policies most advantageously to be pursued, no operator can hope to obtain the greatest economic and social values from forest crops. It is essential not only to obtain and analyze the basic data, but also to constantly study the changing economic and physical conditions affecting them in order that the selection of the quantity and quality of trees harvested may be in accordance with those changing conditions.

Obtaining these data and their continued intelligent interpretation is one of the several phases of forestry practice most essential to an operating concern. The intelligent use of detailed facts relative to timber stands, such as protection of residual stands from fire, insects, disease, and logging damage, is a forest practice which all operators should adopt because so doing means greater profits.

There is one other phase of private forest management that needs emphasis and merits most intelligent consideration by timberland operators. This is the utilization of all forest by-products. The use of forest products other than lumber is at present restricted to a small number of western operators, but the multiplicity of such products and their varied uses can hardly be visualized. Forest research agencies, public and private, will continue to develop products and uses for forest by-products at a pace governed largely by the interest and the desire for such development by forest owners. This phase of forest utilization should be given more consideration by private operators lest further opportunity to increase profits be overlooked.

The beneficial economic results of good forest management are becoming increasingly apparent to those operators who take an intelligent interest in results of research and experience. Such operators will continue to lead the industry into a stable and profitable era, but those operators who, through indifference, inconsideration, or inability to keep abreast of current knowledge, fail to take such advantage not only betray their trust to their stockholders but to society as well.

DESIGN OF TRANSPORTATION PLANS TO MEET THE FIRE CONTROL PROBLEM IN SOUTHERN CALIFORNIA

By A. A. BROWN

California Forest and Range Experiment Station

This article describes the principles and procedure developed for the application of protection transportation planning to the chaparral territory of southern California. Due to the dense and highly inflammable green brush, the precipitous topography, and the climate, fire control here becomes a difficult problem, taxing all the resources and highest ingenuity of the Forest Service and other protection agencies. In spite of the difficulties, the tremendous wealth in orange groves and urban developments within the shadow of the chaparral slopes demands complete maintenance of existing water supplies from the watersheds. Often it is also directly menaced by floods of debris when such areas have been denuded by fire. The project here described represents one phase of the comprehensive plans undertaken by National Forest Region 5 toward meeting the problem.

IN an earlier article[1] the theory of planning transportation facilities to meet fire control needs was reviewed, and the planning procedure was described by which these theories were adapted to typical pine forests of northern California. Urgent need existed to build similar plans for the chaparral forests of southern California, involving chiefly the Angeles, San Bernardino, Santa Barbara, and Cleveland National Forests. In typical chaparral areas, the fire control problem assumes such a different character that many of the premises on which previous methods of planning a protection road system were based, do not apply. Accordingly new premises adapted to the application of the most successful fire control practices in this type of cover had to be substituted. It was then necessary to return to speed of attack on the individual fire as the one essential common to all fire control and to work back from this point to a new working basis and new techniques.[2]

Some of the outstanding characteristics of the fire problem in this territory are, first of all, the dense, highly inflammable brush cover, which limits foot travel to prepared roads, ways, and trails; the extremely rugged topography, the prolonged dry season, the frequent occurrence of strong desert winds, and the dependence and proximity of great metropolitan developments. The interaction of these factors results in extreme local variations in the three recognized elements of fire control, risk, hazard, and values at stake, each of which in turn may become the dominant factor. The character of the cover in the chaparral areas eliminates foot-travel at right angles to auto-roads, which is an essential assumption in the concept of two-dimension, auto and foot, coverage. Accordingly, desirable accessibility must be attained by a process of penetration, by breaking the area up into blocks, and by strategic placement of travel routes for most effective access. The complete dependence on roads and pre-

[1]Design of National Forest transportation plans to meet the fire control problem in northern California.

[2]The project was handled administratively as a joint activity between the Regional Forester's office and the California Forest and Range Experiment Station. F. P. Cronemiller represented the Regional Forester and was in administrative charge of the project; the writer represented the fire research group of the Station. Close cooperation existed and Mr. Cronemiller shared in the development of all phases of the job.

pared ways as a "one-axis" means of access makes them the critical factor in providing any form of management or protection to such areas. The development of the road plan therefore becomes not merely a series of proposed construction projects, but the creation of a key provision designed to meet all phases of the responsibility assumed by the Forest Service in managing forests. The results of this management directly touch the lives of many millions of people in the adjacent territory.[3]

The general problem, which becomes primarily a problem in protection from fire against odds, is of great complexity, and cannot be solved suddenly or perfectly. Many phases must await the gradual accumulation of accurate basic information and the gradual development of new and more effective fire suppression facilities and techniques. But the very practical and urgent problem of providing a systematic and sound basis for the immediate allocation of permanent physical improvements could not await such a solution. Accordingly it must be met by taking advantage of the most successful provisions, facilities, and practices now in use with a minimum of dependence placed on unproven theories. On this basis, the approach became that of examining first the general make-up of the fire problem, then preparing the fire plan best adapted to meeting it. By this process the essential provisions necessary for an improved fire plan were brought out, and the function of roads and other improvements in facilitating the desired fire control performance became much more definitely a logical part of the picture.

The first step in this procedure, the examination of the make-up of the fire problem in the territory, consisted of a preliminary analysis of the characteristics and relationships of the three elements, risk, hazard, and value, as they give character to the southern chaparral fire problem. The significance of each as it influenced the plan which was developed is discussed separately.

Elements of the Fire-Control Problem

Risk, or the danger of fires starting, was the first element of the fire-control problem considered. In the National Forests represented, far fewer fires occur annually than in the more northern pine forests; but the conflagration threat of each fire is much greater. Secondly, 90 per cent of the fire risk in this region is the result of man-caused fires, and these are automatically confined by the dense chaparral cover to narrow limits along restricted routes of travel and around occupied territory. On the Angeles National Forest 85 per cent of the fires have started within fairly well defined risk areas comprising only 15 per cent of the area. For this reason, the identification and definition of such areas and the complete control and prevention of runaway fires from them give unusually good promise of meeting the objectives of fire-control planning. Means to this end were already available in the fire-risk maps developed in the course of earlier detection planning. By depicting clearly the restricted zones within which fires have tended to concentrate during a decade of fire control in the southern forests, these maps served as a basis for the proper hazard-recognition of existing liabilities.

Cover type hazard, the second element,

[3]In most of this territory, the arterial system of highways serving the needs of public and recreational travel is already highly developed. Supplemental recreational development roads, mostly in nonhazardous areas, will be added with the completion of comprehensive recreational planning now under way in the region. Accordingly it was possible to avoid undue complexity by directing the plan toward one general purpose, the facilitating of successful fire control and administration within great areas of valuable watershed.

is of especial significance in the chaparral, because the chaparral represents a distinctive combination of extreme inflammability and physical difficulty of fire suppression. Fires not only spread very rapidly, but they travel through the brush crowns with the typical characteristics of crown fires in timber cover. This means that they are normally exposed to the full effect of the wind, that they spot ahead for considerable distances, and that they generate intense heat and become extremely dangerous to handle once they are well under way.

An earlier detailed cover-type survey made by the California Forest and Range Experiment Station gave a good basis for defining the location and extent of the cover types represented. In all, 14 to 18 types and subtypes were defined. These were combined into six classifications which were considered significant from the point of view of fuel hazard. Although it was believed that the traditional first-line-of-defense theory was not adaptable to the fire-control problem in these types, and that an organization must be built that would be capable of attacking a fire with the strength usually contemplated in theories of second line of defense, yet a practicable elapsed-time limit was considered to be a desirable approach. Based in part on past experience and on statistical evidence, such elapsed-time limits were set up. From these the following travel time allowances were derived:

(1)	Grass Sage—buckwheat Woodland—grass	Flash type, 15 minutes travel time; 30 minutes on desert side
(2)	Chamise Mixed chaparral Big cone spruce	15 minutes or less in high-risk, high-value country
(3)	Dense woodland	30 minutes to one hour, depending on local factors
(4)	Pine Mixed conifers	Together 30 minutes
(5)	Piñon Desert shrub	1 hour; 1 to 4 hours on desert slopes
(6)	Alpine Semibarren Barren	Extended travel time

Where foot travel was feasible, as in a number of these type groups, theories involving the combination of auto and foot travel could be applied. Therefore the same general procedure was followed that was employed in the northern forests, as described in a previous article. The exceptions were type group (2) and parts of group (3), which together constitute about 80 per cent of the territory. In the chamise and mixed chaparral types of cover, the radically different procedure here described was required. The manner in which the foregoing time limits—which in a sense may be termed "hour-control limits"—were used, is developed later.

Values at stake.—In this territory, the third element of the fire-control problem, the values directly dependent on maintaining the forest cover, becomes a highly variable and important consideration. Three principal conditions that make the values at stake a critical factor in this territory are (1) the tremendous importance of the limited water supply from the chaparral watersheds of the National Forests in maintaining high investments and a complex civilization; (2) a severe debris and flood menace contributing a direct threat to urban life and property; and (3) the extremely high recreational value of certain areas. Values in different localities range all the way from 50 cents per acre up to several thousand dollars. Values-at-stake classifications were defined or

forest maps, on a basis comparable to the data showing risk and hazard classifications. Six classifications were used, including two "super-value" classes. They were defined on a broad basis to take account not only of the intrinsic value per acre of the cover lost; but also the "menace value" to adjoining territory directly threatened, if a fire should start. These classifications demonstrated that in this territory, maximum acceptable losses in acreage have little meaning as a basis for general fire-control objectives unless they are considered in relation to the localities involved. In much of the high-value territory, a burn of a thousand acres is not an acceptable loss in terms of fire-control policy, nor is overnight control of an individual fire a sufficient objective. Consequently, a plan of action must be based on stopping many fires at the height of their burning period without depending on nightfall, or more favorable weather conditions to make the job easier. Such considerations have a considerable influence on the general theories developed.

Fire Control Provisions

With the elements of the control problem defined in this way, the next step was consideration of the provisions for adequate fire control. The recognized provisions in a plan of action, which necessarily must vary to meet any individual local fire problem, were grouped into six classifications. The first three involve fire-suppression technique:

1. Method of attack.
2. Speed of attack.
3. Strength of attack.

The last three represent facilities that must be provided on the ground, and are more or less dependent upon the suppression technique:

4. Permanent local equipment.
5. Permanent improvements.
6. Permanent man power.

Method of Attack.—When considered in relation to the southern California fire problem, may follow two distinct general lines, each of particular significance in the transportation plans: (1) direct control, and (2) indirect or block control. In the first case all preparation of fire lines and other suppression measures are performed at the fire after it starts. If it is not quickly controlled by available means, further plans depend to a considerable degree on taking advantage of "breaks". In the second case direct control is also attempted, but fire lines are prepared in advance at the logical places at which to take a stand; and in addition, an attempt is made to establish in advance the strategy to be used in case the fire is not held by the first attack. In chaparral areas of high value exposed to definite risk, where an objective of first-night control is not enough, and where the immediate physical job of control is apt to be beyond the best direct action provisions that can be set up, the block-control method becomes an essential insurance provision. Dependence is placed on backfiring prepared firebreaks in advance of the fire and holding them by the use of water.

Speed-of-attack requirements were set up from hour-control studies and cover type data already available, not in the sense of a one-man first-line-of-defense formula; but as a very convenient means of checking the degree of accessibility by either crews or single men.

Strength of Attack.—A distinction was set up between the need of first attack by an organized crew as compared to first attack by one man to be followed by reinforcement action. The difficulty of prompt control was the factor of greatest influence in fixing the strength of the attacking unit.

Permanent Local Equipment.—This provision was a matter mainly of making tank trucks, pumps, tractors, and other heavy equipment immediately available locally to insure the carrying out of plans

of action called for. Here problems of priority in such investments were introduced.

Permanent improvements and permanently assigned man power, comprising the entire transportation problem, come into the composite picture of fire control as only two of the six provisions enumerated. As such, they must be understood in their relation to the other four, and as part of a flexible combination to be adapted as local conditions require, to the equally flexible combination of risk, hazard, and values at stake. This concept of the fire problem as a continual adjustment of variables to variables requires a thorough redefinition of policies and plans, and this in turn serves to clarify the objectives to be attained in building roads and assigning man power. Since the immediate objectives toward which all this work was directed were that of designing road systems to meet fire control needs most efficiently, and to sufficiently prescribe the placement of man-power for the construction of permanent improvements to go forward the other factors were not carried beyond the preliminary basis described, except as they could influence the pattern of roads.

Since the proper balance of fire-control provisions needed to meet a varying fire problem must largely be resolved by experienced judgment, the writing of acceptable prescriptions could best be accomplished by joint agreement of the fire control administrators concerned. At a conference called for the purpose, distinctive combinations of the fire problem were considered; for example, "high hazard, low risk, low value", as compared to "high hazard, low risk, and high value". In each case a specific, well known locality which best met such description was discussed; and the appropriate degree or variation of each of the six provisions that would best meet the problem was agreed on. In this way, key prescriptions consistent with each other were set up at many points throughout the range of variation in the fire problem.

Cover-type hazard was regarded as influencing most directly the method of attack to be used, and the speed of action necessary to attain burned-area objectives. Fire risk was considered as influencing most directly the permanent man power maintained on the ground; and, in addition, the placing of firebreaks to cut off high-risk areas locally, particularly where the breaks could be located on strategic topographic lines of defense in the probable direction fires would spread from such areas. Values at stake were a financial control over the total investment that could be justified.

Building the Plan

All the preceding analysis, directed towards clarifying the questions of where, why, and in what amount roads and other improvements were needed to meet desired fire control objectives is, after all, subsidiary to the actual building of the network of roads. The huge task of laying out a transportation system on the ground, although it must await the answering of these "background" questions, is not to be overshadowed by them. This part of the job is too complicated for exhaustive description here. Much of the field technique and special variations in practice will accordingly be omitted in the interest of clarity.

The first step in the actual mapping of transportation possibilities was a complete road-log survey of the forest road and firebreak system on each protection unit. This produced many corrections in the road map; and for each existing road also established the distances between intersections, the rate of speed at which a "pick-up" or passenger car could safely travel it, the standard to which the road was built, and the improvements needed

to bring it up to standard or to improve its speed classification. As soon as the road-log survey was completed, a new map was prepared of all existing roads showing their speed classification and the distances between intersections. A supplemental map showed the location of existing firebreaks.

Meanwhile the data covering risk, hazard, and values at stake were assembled; and for the period of record an historical map prepared showing the area burned over.

At this point the actual development of a definite road plan began in the field. Ordinarily a crew of three technical men especially trained at a school held for the purpose, was assigned to each forest. One of these undertook the office work, acting as compiler of the plan while two were engaged in the field investigations. As a guide to plans on the ground, the compiler assembled all fire data for the area concerned for field reference. He obtained the location of all fire guards and suppression crews and, on the new road map, worked out the coverage obtainable *on roads* from these time centers. A special technique was developed here by which minutes rather than miles became the unit of computation. The time limits set up in the discussion of cover type hazard became the general standard of time used. Where dependable accessibility for foot travel was known to exist, as in type groups 1, 4, and 6, two-dimension coverage of territory was worked out. In the chaparral, the graphic coverage showed accessibility by road and auto only. When compared with the problem classification, this also served to reveal the major weaknesses in the existing plan.

One at a time each of the smallest problem units of significance in a protection plan received the attention of the field workers. With the distinctive local classification and the corresponding general prescription in mind, topography, fire history, and other special considerations always posed a problem of application. The starting point was an examination of the fire problem on the ground. The worker familiarized himself with the nature and sources of risk, the features and difficulties of topography, and the nature and distribution of the cover in relation to both in each locality. Then he considered the various ideal provisions that might help to meet the resulting fire problem, and proceeded to test their feasibility and cost. To provide a working basis, the country was visualized as falling into natural fire control units or blocks, such as areas bounded by ridge tops or other natural checks to the free spread of a fire, which could be treated more or less independently. In high-value areas the picture was in the nature of a close-up, the blocks averaging 1,000 acres or less. In low-value areas the field was increased, the blocks varying up to 10,000 acres. These so-called "firebreak blocks", delimited on the field maps, became a valuable guide in planning the road system.

Under ideal conditions each block would be surrounded by both a road and firebreak. Actually, the objective set up for the field investigators was a degree of accessibility by road that would permit (1) first attack in all areas of definite risk either within or adjacent to the boundaries of the block within definite time limits and (2) the placing of backfiring crews with water equipment at any point on a constructed break before a fire travelling at one mile per hour, map distance, could reach it from the nearest assumed source of risk. Depending on existing risk and values, this involved setting-up various degrees of reinforcement of the block boundaries by means of trails and firebreaks. Usually this objective assumed action by at least two crews, the first placed to make immediate attack at the source, a second placed for emergency action on the nearest strategic firebreak.

In developing his unit improvement plan along these lines the field worker raised four questions in his mind as follows: (1) Where is the fire apt to occur and what is likely to happen, judged by topography, past experience, and the evidence on the ground? (2) What accessibility and what advance provisions would be most valuable in such eventualities? (3) What could reasonably be done? (4) How much will it cost? To answer such questions, he must occupy vantage points throughout the area, traverse as far as possible the proposed road routes, compile the key data controlling construction costs, and finally after consultation with local officers develop his local plan. When he felt satisfied with his conclusions, he conferred with the compiler, who applied checks against it of cost per acre, size of block, relation to man power, and the time required for action. This usually eliminated many tentative projects, and often revealed the need of further study.

The compiler gave particular attention to man power needed to effect prescribed action. In addition to applying a special technique for determining time coverage on roads from existing time centers as the picture of the complete system grew, he kept a running check, of just what accessibility could be attained from different road intersections and natural centers. In this way roads could be selected that would best reinforce existing time centers, or that would create the best situation for a new time center; and which would result in a well knit pattern of roads permitting flexibility in action and maximum mobility of man power.

The Conference Review

After this process had been completed and a master plan of proposals had been developed in graphic form on a plan map, a conference was called to review the results and to make final decisions, particularly as they affected the current improvement program and the allotment of funds. Officers responsible for fire control and administration of the unit concerned, and representatives of the Regional Forester's office, and of other interested agencies met with the planning personnel for these conferences. The usual procedure was first a review of the fire history and fire problems of the unit concerned. This was facilitated by associating the existing and past system of man power and improvements with the areas burned over and by examining the relationship of fuel types, fire risks, and values at stake to this association. With this evidence in mind, the general provisions of the plan were first discussed, and then the individual projects were separately discussed and estimated costs were compared to probable benefits. By this method tentative priorities were established and many projects dropped or modified. Following the conference, the plan was then rapidly put in final form, and a separate report written for each forest.

The Resulting Plan

The resulting plan reflected the two purposes which were kept in mind throughout, namely: (1) to provide for acceptable speed of first attack wherever fires were likely to start, and (2) to facilitate effective fire-suppression strategy on going fires. The field study gave particular local emphasis to the second purpose; the office study provided tests of adequacy in pursuing the first.

The road pattern produced in such a road plan is that of a combination canyon-bottom and ridge-top system. In general, the arterial network follows the natural routes of least resistance at lower levels and along major divides. Tributaries carry two-way accessibility to ridge-top levels and to frequent points of contact with constructed or potential fire-

break locations. For obvious reasons, few dead-end roads were planned, and special attention was given to providing accessibility from above to the focal point of the fingering ridges which arise from the main valley fronts.

Prepared fire lines and natural checks to the free spread of fire entered into all phases of the planning project. They were a part of the visual picture by which local territory was treated piecemeal and then joined into the larger design. In addition to functioning as a line of defense, prepared firebreaks serve for accessibility on foot and provide safety to fire crews, which are essential provisions in this territory. It was assumed that with better accessibility by road, the efficient use of water would become a more common and important factor in fire suppression, and that the use of firebreaks as backfire defense lines against "run-away" fires would become increasingly feasible. The nature of the cover as a factor in the problem determined first of all whether the firebreaks were logical means of defense. Justification for their construction depended in addition on their strategic value in the topography concerned; on the probabilities of a planned break being in the right place for use in a specified period of years; and finally if these factors were favorable to breaks, on how intensive a system could be justified by the existing values at stake and the probable savings in fire-fighting costs.

Unfortunately, these justifications lack an exact basis and must be resolved by judgment. For the immediate future construction of firebreaks will be confined to high-risk, high-value areas, and in back-country, breaks will be confined to main divides only. It is expected that intensive front-country protection will reduce the run-away fire liability. With improved accessibility by road, standard methods of directly working the edges of a fire after its first run has occurred, known as "cold trailing", should meet reasonable fire-control objectives in such territory. The determination of priorities within the plan, the determination of justifiable costs, and the further establishment of the role of firebreaks in fire strategy must await further study.

VIEWS OF A PRIVATE FORESTER[1]

By E. O. EHRHART

Armstrong Forest Company

As the membership of the Society becomes larger and the activities of the members more diversified, differences of opinion rather than unanimity of opinion will be the rule instead of the exception. In the following article, Mr. Ehrhart gives the views of a forester, in private employ, on certain administrative forest policies in the Allegheny Plateau region.

AT A meeting of the Allegheny Section a few years ago, a member expressed the opinion that the conception of forestry had changed. He pointed out that formerly wood crops were considered the objective; but that now watershed protection, recreation, game, aesthetic, and similar intangible values were the important objectives.

This sounded almost like an admission of failure. It sounded as though the production of wood crops at a profit is a long, laborious task, impossible of attainment, but that there are new values to be concentrated upon for quick success. The popular appeal of such intangible values is recognized. They cannot be ignored by the public forester, but are they to be the objectives of the profession? Some species of shrub might best serve for watershed protection, engineering dams for flood control, parks and ski runs for recreation, swamps for wild fowl, fruit trees and berry bushes for game, lakes and cliffs with scattered clumps of foliage for the aesthetic value. But must the forester depend on such values to justify his efforts?

Dr. Fernow wrote, (this is abbreviated) "A forester is not . . . a botanist; nor . . . a dendrologist; nor . . . a propagandist; nor . . . a silviculturist; but a . . . technically educated man who, with the knowledge of forest trees . . . combines further knowledge . . . to manage a forest . . . to produce the highest attainable revenue from the soil by wood crops." That was written in 1902; a trifle antiquated, it is true. Today there would be added several more "nors".

Please do not misunderstand me. Public foresters cannot ignore these intangible values any more than private foresters can ignore many business activities far removed from forests. For each type of forester, proper attention to extraneous activities may mean better opportunities for attaining forests that can be maintained at a profit. But let us not lose sight of the main purpose of the profession.

The private and public forester's viewpoints differ. The public forester considers primarily the forest, costs are only secondary. Because he is spending public funds, and just so long as they are forthcoming, he isn't greatly concerned about present profits from wood products, although he may have hopes for the far future. The private forester must consider profits first, before he is justified in recommending expenditures or changes in forest practices.

Often it has been said that private forestry has failed. This is true if industry is obligated to maintain forest growth regardless of cost or possible profit. If, however, forestery is the production of wood crops for revenue, where are the shining examples of public attainments of

[1]Presented at the meeting of the Allegheny Section, Society of American Foresters, Harrisburg, Pa., February 26, 1937.

this objective? This is neither a defense of private nor a criticism of public forestry, but a plea to the profession to recognize these differences.

Today definite hopes of forestry "coming through" in the South may be entertained because of the rapid growth and good markets for young pine. To find every possible factor of advantage in this section of the country where growth is not so rapid, one must go deeper. Here certain sites, mixtures, types, and inaccessible stands do not hold promise for the present; and, therefore, must be disregarded for the present at least, and efforts concentrated on limited areas where natural conditions are more promising.

It has been said that stumpage values are too low to permit forestry. Yet, if low stumpage values are maintained, better prospects for closer and more widespread utilization, with the attendant increase of industry and employment, are possible.

Since 1933 stand improvement has received much attention, but almost invariably this meant the expenditure of money with no immediate return. Usually it aims at increased quality and quantity of future wood crops, but with little attempt to make it pay its way now and without regard for a return on the investment. If a stand is improved through a profitable cutting operation, fine; but if funds are spent for which a return in definite expectation value cannot be measured, is that forestry?

The foregoing is a sufficient generalization. Now the forest conditions on the Allegheny Plateau of northwestern Pennsylvania will be described, and certain operating factors discussed which have a distinct bearing on the possibility of profitably growing wood products.

In this region most of the virgin timber has been removed. For this reason the forester has to work with second-growth stands, most of which are under fifty years of age. Here the beech, birch, and maple type is the principal forest type. The chief difference between the second-growth and virgin stands is the proportion of hemlock and black cherry. Hemlock is scarcer in the second-growth and cherry more abundant. Ordinarily, second-growth stands are only considered potential producers of future wood products. In this region, however, second-growth stands are capable of producing a yield in excess of the immediate demand. In fact, one of the big problems confronting the Allegheny National Forest, and also to some extent state forests, is the development of a market for material that could now be harvested, and the establishment of new industries to utilize crops definitely available in the near future. At the present time most of the yield from this second-growth forest is chemical wood and pulp wood and only a comparatively small amount is saw-timber. Undoubtedly if such stands were not cut, they would produce future saw-timber. However, studies have indicated that the largest yields from these stands can be secured by removing the dominant trees and leaving those trees particularly well adapted to develop into quality saw-timber. The overstory must be removed, however, when the stand is thirty to forty years old. If it is not removed at this age, the future saw-log trees are rapidly suppressed, and the present dominant trees, which usually develop forked and spreading crowns, form the basis of the future crop. It has been definitely determined that when the stand is cut this way at the proper age, the remaining trees respond remarkably to such liberation. True, not all second-growth stands will respond; but why not segregate those that will for immediate concentrated treatment?

At the present time the stumpage value of chemical and pulp wood represents approximately only 10 to 15 per cent of their value delivered at manufacturing

plants. This means that logging costs make up most of the 85 to 90 per cent of the delivered cost. Obviously a saving might be made by reducing logging costs. Auto trucks, tractors, and trail builders, as developed during the past decade, have made possible a great advance toward the practice of profitable forestry not only because their use has made stumpage more available, but also because small areas can be profitably logged with them. Why not use this equipment, especially the trail builder, to improve the value of the stand by making it more accessible?

During the past few years, a great deal of time and effort has been expended through the C.C.C. to build forest roads. These roads are creditable pieces of construction; and, as far as they go, are of value in protecting and making some areas more accessible. Judging by the location of some of these roads, and the repeated change of specifications which involved much repetition of work, it appears to an observer, as if the main objective of the work was to keep the men busy. This is not intended as a criticism of past performances. Undoubtedly there are many good reasons and much justification for doing what has been done. But would it not be more useful to expend more of this effort in building a system of roads through timbered areas selected because they held the greatest promise of an early and heavy yield of wood products? If these roads were so located that they would be of permanent or at least periodic value; if they were merely rough graded in operating width at the lowest possible cost so that maximum mileage would be attained; if they radiated through the forest so that no tree would be more than five to ten chains distant therefrom; would this not in practical effect result in stand improvement? Furthermore, would it not add materially to the stumpage value; would it not make stumpage more attractive to prospective purchasers; and logging jobs more attractive to small operators or contractors?

It seems quite clear that it will be necessary to depend on small operators to do the woods work. Usually, however, such operators are neither financially equipped nor materially interested in constructing roads which would tie into a comprehensive plan for a permanent road system. Permanent refers to the location rather than the physical condition of the operating road. The maintenance of such roads only needs to be considered periodically when timber is cut.

This suggestion for more and better located operating roads is not merely a fantastic idea out of the blue. For years, on lands under all types of ownership, small areas of windfall or scattered overmature and dying trees, for instance, have been wasted because the quantity was too small or too scattered to warrant opening up roads to salvage it. Last March a severe ice storm in the region damaged thousands of acres of all classes of timber, especially timber located at the higher elevations. The severity of the damage, which varied from slight to 100 per cent, not only increased generally with the elevation, but also changed with aspect. Much of this timber must be salvaged. But to salvage it a comprehensive system of roads extending from the valleys to the higher elevations and serving every portion of the large area affected should be built. With such a road system in second-growth forests, cutting operations which also result in stand improvement would be more practical.

LET'S APPRAISE THE SITUATION

By KENNETH J. SEIGWORTH

The place of wildlife management in forestry has received much consideration during the past few years. That there is still considerable difference of opinion regarding this relationship is indicated by Mr. Seigworth's paper.

A POLL of technical workers in the following fields: flood control, soil erosion, and wildlife management, and others interested in the conservation of natural resources would undoubtedly show that foresters either directly control, or are influential in determining the policy and administrating most conservation activities. A poll of this group to determine whether they have confidence in this leadership and are in accord with existing policies would show, it is believed, that not only the leadership would be questioned but also that drastic policy changes are needed to bring about a coordination of effort. These facts are so apparent that they are causing considerable concern to many foresters convinced that timber growing is an important objective in the management of forest lands, but who also believe that most forest lands should be managed for multiple use. Are the recognized forestry leaders aware of this attitude of other conservationists? If so, are they attempting to reckon with it; or are they taking a blundering or condescending position reflecting what may be temporary control?

What are some of the realities?

For a variety of reasons forestry and foresters took early prominence in the conservation movement. The early leaders in the conservation-of-forests movement such as Theodore Roosevelt and Gifford Pinchot were not only energetic and public-spirited; they were also expert propagandists and dramatists. Besides, the disappearance of forests was something the public could see, and the prospect of a timber famine was a fearful one to an expanding nation. Furthermore, the conservation-for-use doctrine appealed both to the realists and to the sentimentalists. In short, the practice of sustained-yield forest management appealed to the public as a sound idea.

The history of forestry in the United States is interesting and stimulating. It reflects credit on the profession. The major events may be briefly summarized as follows: establishment of National Forests, development of reasonably satisfactory fire control over much of the country, establishment of State Forests (in a few states), initiation of forestry extension, focusing public attention on related conservation problems, and stimulation of some interest in private forest operators.

Throughout the history of the movement some foresters talked about flood prevention, recreational possibilities of the forest, preventing soil erosion, and that more fire-free forests meant more game. Some talked because they believed; others found these related objectives good propaganda; still others wanted the support of particular groups interested in these specific problems. Many conservationists sincerely believe that *talking* largely represents the net results in those phases other than timber growing. They question today whether foresters really believe that multiple use of forest lands means more than construction of truck trails, fire towers, tree planting, and timber stand improvement.

A few examples may be cited to illustrate some reasons why wildlife experts and enthusiasts are skeptical about the forester's interest in wildlife conservation.

The writer recalls vividly that in a widely used silviculture text which he studied, certain species of wildlife are discussed purely as enemies of the forest. In the *third* edition, the author refers to

a similar criticism from another source and concedes that the viewpoint is justified that "wildlife should be accepted as an agency in production, to be developed in forested areas together with timber production and other agencies which may increase the sum total of financial return." The author goes on to show that deer, beaver, porcupines, rabbits, squirrels, and mice are enemies of the forest. He does make the statement that "the beneficial influence of birds outweighs their injurious effects upon the forest." Careful reading of this third edition by an experienced forester leaves him with a properly balanced point of view. However, the net impression on the casual reader and on the average sophomore forestry student is definitely that forest wildlife must be kept under rigid control.

This example is significant because the majority of foresters who have studied silviculture at forest schools since about 1920 probably have used this text. The fact that the author is influential in the profession; that he enjoys a well-earned prestige; that he is a practicing forester managing forest lands where profits are a management objective, is of added significance. The writer has frequently had passages from the foregoing textbook quoted to him as the typical forester's attitude on wildlife.

Most foresters, particularly members of the Allegheny Section, will recall the heated discussion regarding deer damage to Pennsylvania forests about 1931. That deer were dying of starvation, and that edible vegetation from the ground to as high as a deer could reach was being extensively dstroyed, were facts generally admitted. Much discussion was heard and read regarding alleviation of the situation through control measures, most of which were directed toward reducing the number of deer. The Pennsylvania Game Commission liberalized shooting regulations and carried on extensive artificial feeding. To the writer's knowledge, however, no forester suggested the possibility of providing better browse conditions in the forest.

Not long ago some conservationists heard acrimonious tales regarding the death of considerable wildlife as the inadvertent result of poisoning porcupines on an important publicly owned forest in a multiple-use-conscious northeastern state. Others recall the furor over the poisoning of snowshoe rabbits in Wisconsin in 1933. Here again the entire forestry profession was accused of intolerance and lack of intelligent sympathy.

Whether the widespread destruction of such species as service berry, dogwood, holly, persimmon, wild grape, myrtle, and wild apple by C.C.C. activities carried on under the name of "timber stand improvement" was really necessary is still a matter of controversy. Skeptical eyebrows are raised as to whether this was even good timber growing practice; there is now rather a general agreement that it was not.

The inference in the "Wildlife, A Forest Resource" section of the Copeland report that more publicly owned forests will automatically result in more wildlife detracts seriously from an otherwise well prepared report. One brief paragraph to the effect that administrators of our State and National Forests were cognizant of, and taking steps to improve, necessary habitats for wildlife, in addition to fire protection would have added immeasurably to the effectiveness of the arguments presented. Would a truly sympathetic and wide-awake reviewer have permitted such an oversight? These five items were selected at random from a large group which might be mentioned. Each has been influential in creating an attitude of distrust of many wildlife conservationists.

A similar array of incidents has been cited to the writer by forest recreational enthusiasts. Although the forester can cite some definite advances in these fields by his own profession, such as the addi-

tion of wildlife technicians and recreational experts to forestry staffs, and increasing cooperation between the Forest Service and the Biological Survey, and between state forestry and game departments, he is confronted with a multitude of embarrassing arguments. The situation is not improved by criticism which might be directed against park and game enthusiasts in their management of forest lands. Differences in the organized conservation ranks which go beyond scientific differences of opinion are developing.

It is becoming increasingly serious because specialized techniques are rapidly being developed in the related conservation fields, and experts in work other than timber growing are rapidly gaining public and professional prestige.

Growth of Other Professions

Until 1933 forest developments represented by far the bulk of the governmental activity in conservation. The tremendous funds made available through emergency and relief activities gave many groups an opportunity to experiment and demonstrate their particular cure-all or palliative in treating the disease dissipating our natural resources. Witness the growth of the Soil Conservation Service, the National Resources Board, the establishment of the T.V.A., the expansion of National and State Parks, the selection and functioning of planning boards, the F.E.R.A., the N.I.R.A., the many flood control commissions; and, of course, C.C.C. camps were parcelled out to nearly every group interested in conservation—the suddenly popular and well financed undertaking of the Nation. As might have been anticipated, most of these groups had some sound ideas. As might also have been expected, each group immediately launched an extensive propaganda campaign to sell its cure-all or doctrine to the public. As a result, jockeying for position and appropriations was intensified. Rivalry between these conservation groups has already overstepped the bonds of healthy difference of opinion necessary for scientific advancement. The bickering between two of the larger federal agencies is notorious. Investigation shows that men with forestry school education are liberally sprinkled through most of these agencies.

Every forester might well become familiar with the growth, expansion, and strength of the American Wildlife Institute. It is mentioned here because its internal organization shows a long stride from the old time politically dominated sportsman's or fish-and-game organization at which foresters have been inclined to look askance. Note some of its accomplishments to date. The establishment of the cooperative wildlife research and experiment stations at representative land grant colleges is notable and represents real progress in conservation. Then examine its "technical committee", which acts as a board of directors in directing its activities and formulating its policies. It is a committee of technicians. Many a forester will be surprised to learn that its chairman, Aldo Leopold, was educated as a forester, spent many years with the U. S. Forest Service and then started the tremendous task of assembling the available facts and techniques pertaining to wildlife management. Another member, Gardiner Bump, also a forester, is an expert on birds and reptiles. He is now actively practicing multiple-use management of forest lands in which wildlife is the primary objective of management. Herbert L. Stoddard, a third member, is the country's outstanding authority on the bobwhite quail.

The same group of foresters who are unfamiliar with the Wildlife Institute will also be surprised to learn of the large number of specially trained wildlife technicians already practicing a comparatively new profession on forest lands in many sections of the country. It gives some of

us a real shock to find that the bulk of these men have at least a bachelor's degree in forestry and that their wildlife training has been of graduate grade. They know as much about timber-growing as the average forest school graduate; and, in addition, have the wildlife knowledge.

The same situation is found with many of the recreational engineers or recreational specialists. The irony is that many members of each group feel that the forestry leadership is out of sympathy with their major interest.

The forestry profession runs the risk of having the scope of "forester" and "forestry" much restricted in the future. The average citizen regards a forester as one who knows something about planting and pruning trees, about the control of forest fires, and about "clearing out the underbrush so the good trees will grow faster." The average wildlife enthusiast and recreational enthusiast will be more generous in his definition, but not much more.

During the years 1935 and 1936 the writer was engaged in administrative work with a federal agency carrying on a large scale submarginal land purchase and multiple-use development program in close cooperation with seven states. The organization in this particular district employs forty engineers (mostly civil), thirty-two foresters, twenty-seven trained wildlife technicians, twelve landscape architects who have specialized in forest recreation, and fourteen agricultural economists. Each one has at least a bachelor's degree, and many hold masters' degrees. The average age is approximately thirty years. Most of the foresters previously were in state or federal employ; most of the engineers in private industry; and most of the economists with colleges or universities. Some of the wildlife technicians were employed as foresters before specializing in wildlife. It is believed these men represent a fair cross section of conservation thinking and attitude. The economists and engineers probably grasp the multiple-use idea as well as the others. The economists and engineers are reasonably free from bias as between game, timber, and recreational facilities. They have watched with interest the rivalry among the foresters, the wildlife technicians, and the landscape architects. Their collective opinion is that the foresters are apparently interested only in communication and fire protection facilities, in tree insect and disease control, and in timber stand improvement. That, in their opinion, is forestry. Unfortunately, many of the foresters are beginning to recognize the same definition.

When this work was being organized, the director was urged to select a forester to direct the development work. In view of the fact that this man has national standing as an agricultural economist and that he has a reading and speaking acquaintance with most of the well known foresters north of the Potomac River, his comment is significant. Interpreted and condensed it was, "I would, if I knew where to find a forester who knows something about organization and at the same time is sincerely interested in multiple-use development of wild lands."

The writer is one of that group of younger foresters who believe in the husbanding and use of our natural resources, both plant and animal; in flood control; and, furthermore, that the job is big enough to exhaust the energy and knowledge of experts in all phases of conservation. They also believe that wildlife and recreation management on properly managed forest lands do not clash. This group of foresters further believe that specialists in all three of these phases may and should properly be termed foresters and should be members of the same professional organization. They ask only for a broader interpretation and recognition of "forestry"; a closer unanimity of organization and action. They believe that school curricula need drastic revision and that the attitude of the Society should be changed.

MANAGEMENT OF IDAHO WILD LANDS[1]

By R. H. RUTLEDGE
U. S. Forest Service

Land-use planning, particularly the development of techniques of wild-land management, increasingly engrosses the attention of the forest administrator. With new and greater demands being made upon the organic resources of the forest, he must provide for flexibility of use while keeping intact the basic resource—the soil. The author, who is Regional Forester of Region Four, describes how the U. S. Forest Service has developed its system of multiple-use management of the National Forests in Idaho.

IN THAT portion of the United States lying west of the 100th Meridian is a vast domain of grassland, sage, forest, and desert, which by its nature cannot be considered as anything but wild land now or in the future. This huge area, amounting to about 800 million acres and representing 82 per cent of the total area of that region and 42 per cent of the total land area of the United States, has never been clearly recognized as the last remaining storehouse of our natural resources containing forage, forests, wildlife, soil, and minerals. It is not surprising, therefore, that the economic importance of large areas of these wild lands has been underestimated.

One of the principal difficulties of proper management is the exceedingly complicated one of land ownership or jurisdiction. About 50 per cent of this wild land is controlled by a great number of private owners; the balance is in various forms of public ownership, both federal and state. This multiplicity of jurisdiction in many public and private agencies presents a serious handicap to the eventual attainment of better management.

Although the question of wild-land management concerns the entire West, I shall confine my discussion of it primarily as it applies to the state of Idaho. Idaho is a relatively young state. Its economic development has become definitely established along courses determined either by climatic conditions, characteristics of its people, or other important factors.

Idaho is not, and probably never will be, a manufacturing state. Its chief source of wealth and its future prosperity and welfare will continue to be based on the use of land in its various forms. It it important, therefore, that this fundamental source of wealth be used, perpetuated, and improved in such manner as to contribute most to the permanent combined welfare of the individual user, the community, and the state.

Land Use

Because of climatic conditions, rainfall, and topography, the area of land suitable for agricultural development is limited. The total area in farms is now about 9 million acres, of which about 4 millions are in cultivated crops. An additional 1½ million acres can be irrigated at a reasonable cost for water. Thus it is evident that only a maximum of 10 per cent of the state can ever be considered as agricultural and that the remaining 90 per cent will probably always remain wild land.

The wild land falls naturally into two principal classes—open-range land and forested land—which may or may not be suitable for grazing. Twenty million acres,

[1]Condensed from a paper presented at the Idaho State Planning Board Recreation Conference, Hailey, Idaho, August 1936.

or 37 per cent of the total state area, is forested; about 29 million acres, or 53 per cent, is open, largely treeless range country. This vast domain of wild land and its resources in the form of grazing lands, watersheds, minerals, valuable timber lands, and recreational areas are of utmost importance to the industries and people of the state. The integrated and interwoven relationship of the various interests in these wild lands often is not fully realized.

The interest of crop-producing agriculture in the proper handling of wild land may be taken as an example. This interest arises from two fundamental relationships: one is water, and the other is the consumption of crops. Water in this western country is nearly always the principal factor upon which agricultural stability and progress depend. Water, however, creates its own problems of run-off, storage, and distribution, which must be solved before its full value can be realized.

About 85 per cent of the water-yielding areas of the West are wild lands. In Idaho they are largely forested lands and upon them are dependent the intensively developed and valuable irrigated lands in the lower valleys. These watersheds must be so administered and managed that they will deliver a regulated run-off throughout the growing season, year after year without erosion or floods.

Grazing

The agricultural lands are dependent also upon the livestock industry as a market for their forage crops. In the western range states, for example, 35 per cent of the food requirements of livestock is supplied by supplemental feeds raised on cropland or irrigated pastures. It is evident, therefore, that the farmer is deeply interested in wild-land use since upon its proper management depends both his water supply and his market for hay.

The livestock business is one of the primary industries. It has grown to its present importance in Idaho, and in other western states, because of the enormous wild-land resources which it has used from the beginning at little if any cost. Sixty-five per cent of the western livestock industry feed requirements are derived from it in the form of native forage. Although the forage production of the range lands has decreased alarmingly, varying from 30 per cent to 67 per cent on lands in different ownerships and under different forms of management, the wild-land range is still indispensable to the stockman. With the decrease in carrying capacity of the range lands, the livestock industry has been forced to depend, more and more, upon forage crops produced on irrigated farms of the state.

The National Forests of Idaho alone graze during the proper season 57 per cent of the sheep and 17 per cent of the cattle in the state. Thus it is evident that to a considerable extent the future of the industry depends upon the permanence and continued high carrying capacity of the National Forest ranges. Following the market depletion of other grazing lands, public and private, the demands made for grazing on National Forests have increased many fold. We have available, however, information as to actual carrying capacity, and the range is not excessively stocked. The carrying capacity has been determined only after careful studies have been made as to the nature and usability of the forage, game requirements, tree growth, watershed conditions, and recreational needs.

It is unfortunate that the wild-range lands of Idaho and other western states have not all been used and managed from the beginning on the sound land-use principle of sustained yield which the Forest Service adopted when it began to administer the National Forest range. The carrying capacity of the open range has been reduced so materially that livestock

must be decreased as to numbers and seasonal use. Furthermore, depletion of the plant cover has resulted in serious maladjustments in other respects, such as erosion and impaired watersheds which vitally concern all the people of Idaho.

It is evident that unregulated and excessive grazing has brought about problems which the present and future generations must face and solve. The serious reduction in the carrying capacity of a large portion of Idaho range has occurred in a relatively short period of about 56 years. Forceful action on the part of public and private agencies is needed if further depletion is to be arrested and nature permitted to begin the slow process of rehabilitation.

Lumbering

Another important industry, which finds on the wild land its sole source of raw material, is lumbering. From a modest beginning in 1880, it has grown to be the principal manufacturing enterprise of Idaho, both in number of men employed and in the value of products produced. During the past 50 years, and especially since 1900, this industry grew rapidly, until in 1929 it reached a peak cut of over one billion board feet which, after being manufactured, were worth $34,000,000. This heavy drain upon the forests of the state can have only one possible result, and that is the fate of the older logging regions of New England and the Lake states where the cutting of timber, more rapidly than it grew, resulted in the destruction of the lumber industry.

The lumber industry in Idaho should and must be maintained in perpetuity. As far as the resources of the National Forests permit, they are dedicated to the accomplishment of this purpose. The National Forests, however, support only 60 per cent of the timber commercially accessible; the remaining 40 per cent is in private and other ownerships. Because the private lands are more valuable and more accessible they naturally have been exploited first, and we now find that 62 per cent of Idaho private timber land has been cut over, leaving only 38 per cent for future lumbering. At the average rate of cutting during the past 10 years, the remaining privately owned timber represents an operating period of only about 20 to 25 years. Consequently, unless the lumber industry adjusts its cut to the annual growth in the meantime, by 1960 the lumber industry of Idaho will be reduced to half its present size and will be confined largely to timber on National Forest lands.

A reduction in this important industry will, however, have other effects. The once virgin private timber resource eventually will be largely cut-over land in poor growing condition and slow in producing another crop of timber. Once valuable lands will be left, as they are now fast becoming, a liability upon the state and the counties with little or no revenue-producing ability. Because of inadequate protection, they will become further depleted by fire.

Not only will the communities once dependent on the forest for their existence suffer, but also the watersheds, fish, game, recreation, and other industries will feel the economic impact resulting from the depletion of the timber stands. Although the timber of the National Forests will, in a measure, absorb the shock, nevertheless, the state's principal manufacturing industry continues to operate on the basis of immediate returns as the sole objective. We cannot blame the owner, the logger, or the sawmill operator alone; we must also place a proper share of the blame upon the nature of existing tax laws and the inertia of the citizens of the state.

Mining

Although not so closely linked to wild-land use as grazing and lumbering, never-

theless, mining comes into the picture in a manner which demands consideration. The early history of Idaho is largely a story of mining development. First it was placer gold which brought people in considerable numbers to the state. But more permanent forms of mining followed, and now we find this industry one of the most important in Idaho. In 1929 the products from mines were valued at approximately $14,000,000.

The search for valuable minerals has had a marked effect on the past development of the wild-land areas of Idaho and will continue to influence their development in the future. The discovery of mineral wealth always results in transportation systems, and roads and trails foster other uses of the wild lands which they open up. There is no conflict between legitimate mining developments and other wild-land uses. The miner makes exclusive use of but a small area and is interested in the protection and development of the surrounding timber which he must have for his business.

Recreation

It is hard to draw the line between the use of forests for wildlife and for recreation. Recreation is of many sorts and can be secured in many ways. When we of the Forest Service speak of it we mean that group of outdoor activities for which thousands leave the valleys and towns and go to the forests or the hills seeking rest and relaxation. Hunting, fishing, camping, picnicking, hiking, botanizing, with their innumerable variations, are all included. The use of wild lands for recreation developed rapidly as improved roads, cheap cars, and shorter working hours made it possible for all classes of people to participate.

Whereas 3,000,000 people sought recreation in the National Forests of the country in 1917, some 56,000,000 visited them in 1935. A multitude on the move spends a lot of money and makes a very sizable contribution to the prosperity of the towns and communities adjacent to the Forests. It has been estimated that the expenditures for forest recreation in the whole country amount to $1,750,000,000 per year.

In Idaho, where the largest unbroken wilderness of any state sweeps from the Wyoming line over a thousand miles of rugged mountain country to Canada, we have a wonderful opportunity for the development of recreation of all sorts. The greater part, over 20,000,000 acres of Idaho's most rugged mountains are in the National Forests, and the Forest Service has long appreciated its responsibility for the development of recreation. This use has been growing rapidly in southern Idaho; last year 775,000 people used our forests for recreation, an increase of over threefold since 1924.

For those who desire to rough it and enjoy nature in the raw, the National Forests of Idaho provide large areas of back country, little changed since they were first visited by white men. Two of the wildest, comprising 2,668,000 acres, have been set aside as primitive areas. Because of their location and rugged topography, they have been very little used. Few roads extend into them and no additional roads are planned. No economic developments can be expected for years.

However, a complete system of trails is being constructed so that they may be protected from fire and will be accessible to hikers and pack outfits. The use of these areas is growing rapidly and they are already famous as big game hunting grounds.

Wildlife

Once an abundant natural resource, wildlife was not fully appreciated until its various forms became scarce or were faced with extinction. It is one of the state's most valuable resources, distinctly a product of its wild land. Within the National

Forests of Idaho are estimated to be 65,000 deer, 11,000 elk, 500 moose, and 1,800 bighorn sheep, 3,000 mountain goats, and 3,500 antelope. Since the game population of Idaho is found principally on National Forest lands we cannot avoid being intensely interested in its proper management.

It is generally recognized that an improper balance between summer and winter ranges now exists because of the passing into private ownership of lands once used exclusively by game during the winter season. Summer ranges can maintain greater numbers of big game than the remaining available winter range can support. The obvious answer to this problem is that, if the desired game population is to be maintained, plans for extending the winter range must be made, and funds made available for purchase of privately owned land where needed. There is no serious conflict between game management on the National Forests and grazing by livestock or other uses. The existing policy of correlating the several normal uses makes possible needed adjustments and the eventual establishment of the proper balance.

Sustained Yield Management

The National Forests of Idaho have been under management of the Forest Service for 30 years. When they were first handed over to the Forest Service the resources contained therein were in various stages of use and disintegration. Generally the timberlands were untouched except by fire; grazing lands were badly overstocked and depleted; the big game population was inadequate. The wide domain of the forest was inaccessible, and, except to the stockman, hunter, and prospector, unknown.

The first question of management that was decided was a governing principle, a policy which would endure and form the foundation of all future operations. From the beginning the doctrine of "the greatest good to the largest number in the long run" has been followed. Public lands by virtue of their ownership vested in the people cannot be managed on a basis of other than perpetual and undiminishing returns. This basis of management, commonly called sustained yield, uses only that which is currently produced by nature.

Sustained yield cannot operate on a basis which reduces the capital investment in organic natural resources. I have already pointed out that the lumbering industry on private lands in Idaho generally has an expected life of only 20 or 25 more years. Obviously, this is not sustained yield. Reliable investigations have shown that the public grazing lands of the Snake River plains have suffered considerable depletion as a result of overstocking and improper seasonal use. Sixty-five per cent reductions in desirable forage plants over millions of acres of once valuable range lands are indicated. If such reductions have occurred during the relatively brief period of white man's occupancy and use, what can we expect the future to bring about unless radically different forms of land use are adopted?

As opposed to the unregulated system of use let us consider the method of utilization in National Forest timber. Except for preserving virgin conditions along important highways and in the vicinity of recreational centers and other situations where the aesthetic value outweighs its usefulness for saw timber, the conservative harvesting of timber on a sustained-yield basis is not inimical to other uses.

Moreover, the harvesting of timber on a sustained-yield basis goes hand in hand with the preservation of forests and of related resources for other purposes. For example, we advocate the selection method of cutting in our timber stands; that is, the removal of mature timber in order to give young and thrifty trees a chance to grow at a maximum rate and produce merchantable timber for a future crop.

Multiple Use

Sustained yield itself is not the complete answer to proper land use. Management of wild land means searching out their every potentiality for service, their every possible source of sustained wealth and revenue production, and fitting them into a pattern of land management which will promote sound public economy. This idea of land management as practiced on the National Forests is aptly described by the term "multiple use".

Multiple use of land means its use for watersheds, timber growing, grazing, mining, fish and game production, and recreation simultaneously. When properly integrated and adjusted these uses can occupy the same land without conflict. For example, watersheds under the Forest Service policy of sustained yield and adequate protection are amply safeguarded although timber utilization and grazing may be carried on. Grazing under proper control does not interfere with natural reproduction of forests, nor do logging operations interfere with grazing except over limited areas during brief periods. Obviously recreation, timber production, and watershed uses go hand in hand with wildlife.

Grazing and game sometimes appear to be in conflict, but in such cases the fundamental difficulty is usually the lack of correlation and proper adjustments among the agencies having jurisdiction. Game management is nothing more or less than the method used in range management of keeping the number of animals adjusted to the amount of range available. Game animals must be protected and additional winter range must be provided when necessary. There is no logic in producing large numbers of game and allowing the surplus to die of old age, disease, or lack of food.

Recreation demands exclusive use on but very limited areas which are devoted to camp grounds and resorts. These areas, as compared to the large size of the National Forests of Idaho, are insignificant. Thus with this small exception, National Forest recreation can continue to flourish and expand without detriment to grazing, timber production, watersheds, and wildlife. Recreation fits into the pattern of multiple use easily and smoothly, and under proper management should not suffer from the other uses to which the forests are devoted.

The people of Idaho are becoming familiar with the doctrine of multiple use as opposed to single use, and the principle of area administration rather than functional control. Some enthusiasts would have us devote large parts of forests exclusively to recreation or even turn them into National Parks. Others would devote large areas to game production to the exclusion of the livestock industry and without regard to the game needs of the state. Some even advocate administration by resource divisions or functions. As examples, we find persons who believe that all recreation everywhere should be handled by one agency, that all game should be handled by another agency, and that range and timber resources and watersheds should each be in charge of a distinct governmental organization. To all clear-thinking individuals this plan to establish administration by functions is a ridiculous fallacy, and is no doubt the outcome of the reasoning of enthusiasts who believe that they know more about one particular thing than anyone else or who imagine that they are the self-appointed saviours of some particular resource.

The Forest Service holds that functional administration is absolutely impractical on National Forests or public lands which are needed for various uses. Such administration could result only in endless confusion and friction. The only proper method of administration of public lands, such as the National Forests, is by a single agency in charge of all functions so that the interests of the various resources and uses can be integrated.

THE EFFECT OF RECENT ECONOMIC TRENDS AND RESEARCH ON THE FINANCIAL ASPECTS OF FOREST INVESTMENTS

By CHARLES H. STODDARD, JR.
Northeastern Forest Experiment Station

In the past, sustained-yield forestry has had to compete for capital with high-grade stocks and bonds yielding comparatively high rates of interest. Due to the supply of capital available for investment, interest rates have fallen from 6 to 2½ to 3½ per cent. This reduction, together with the fact that in many cases the indebtedness of the industry can be refinanced at lower interest rates, should have a favorable effect on sustained-yield forestry.

SOME of the major economic changes which have been taking place in recent years may be the turning point for the lumber industry from management on a liquidating basis to a permanent one. In the past it has been more profitable to convert timber capital into money for reinvestment than to keep this capital intact in a growing forest. During the stage of rapid development of the lumber industry up to the World War, reinvestment of these funds into more standing timber was the practice and continued until most of the available publicly owned timber had been acquired or placed in National Forests. Since this time, and prior to the depression, the policy has been to invest these stumpage depletion reserves in the securities of the many new industries which were developing. This practice proved to be very lucrative while secure high-grade bonds and stocks were available, which paid very good rates of interest.

During the depression all types of businesses which by nature pile up cash reserves for investment experienced difficulty in finding securities yielding the accustomed rate of return. Even now the supply of capital available for investment far exceeds the demand by new issues of stocks and bonds. Consequently the rate of interest which borrowed money commands is proportionately low. The banks have reduced their interest rates to 2 per cent, government bonds are only paying between 2 and 3 per cent, and even stocks paying good dividends are valued so high that the yield is kept comparatively low. The 6 per cent of yesteryear has given way to 2½ or 3½ per cent.

One of the greatest difficulties that forestry practice and the lumber industry has met with has been this economic obstacle. Forestry could not produce an income comparable with other investments while interest rates were high. An opportunity is now available to those interested in industrial forestry if use will be made of some of these broader economic changes.

It appears entirely reasonable that instead of liquidating an investment in standing timber and loading the funds so derived on a money market which will pay little interest, the timber investment would be better off if kept intact and managed on a sustained basis which will retain the capital values in the forest. That growth rates in many regions can compete with or exceed the 2½ or 3½ per cent which present sound investments yield seems probable. No increase in interest rates is expected for some time to come because of the large supply of money available in the capital markets and, even if there should be, it is unlikely that they will ever reach the old levels.

Standing, growing timber is considered one of the best hedges from inflation according to Babson's Institute. With apparent fear of possible inflation on the

part of many investors, it is reasonable to expect sustained yield forests and their products will maintain their real values as well as any other commodity and at the same time cover fixed costs by growth. Thus, it now appears that the most potent argument to convince the lumberman of the financial practicability of a sustained yield is that forest capital kept intact is a very sound form of investment.

The problem of reorganizing a forest industry for a permanent timber supply contains numerous financial angles which lumbermen must become familiar with. In the first place, any system of partial cutting leaves behind a tangible asset on the ground which can be retained only by the continued payment of taxes. Those states which have altered their forest tax laws offer substantial reductions from the general property tax. It is possible to show that with this reduction a definite saving may be made by the owner if his land is registered under one of these laws. Growth acceleration resulting from partial cutting should allow the forest to more than cover its own carrying charges under such a system of taxation. Since money saved is money earned, the lumberman can find a substantial incentive in this instance for practicing forestry. There are other angles of attack which must be used because forest tax laws are not a sufficient incentive in themselves. Past experience has borne this out.

Another additional favorable economic factor appears in the opportunity for lifting the debt burden which the industry assumed in the past and which constituted a very strong pressure for liquidation. This may be done either through federally financed forest credits, if they become available, or, in cases of companies in a strong position through the ordinary channels of refinancing. The combination of long term loans, in place of serial bonds which come due annually, and lower interest rates will aid in relieving an economic pressure which in the past has required complete liquidation of forest values.

Recent research in logging and milling costs also show the way towards increased profitability in forestry practice. It has been amply proven that the cost of handling small logs from the stump through the mill is greater than the ultimate value of the lumber produced. This naturally varies considerably by regions and species and holds true only up to a certain point, depending upon the degree of utilization. In any event, cost studies show that positive financial savings can be made by leaving small timber in the woods, since it is of marginal or submarginal value. The removal of large trees containing the majority of higher quality lumber increases the final value of the product and results in a higher proportional net income from the volume cut. Thus it may be concluded that it is merely good business to leave small timber on the ground.

One of the principal objections in the past to plans for permanent or semi-permanent operation of a forest has been that the improvements needed to log a tract are much more costly per thousand under selective logging. The problem of handling such items as depletion charges, road and railroad construction costs can be solved with less difficulty than is sometimes thought. Ordinarily, money tied up in stumpage is set up in a depletion fund for the purpose of capital replacement as the timber is cut. As mentioned above, such a practice at present involves the difficulty of investing these funds at profitable rates. Under sustained yield practice where the growth theoretically balances the cut, no charge would be necessary. Cutting on this system of management involves only forest income and is not capital depletion. Accountants may argue this point by saying that cutting timber actually involves depletion of an asset. The forester's answer to this is that depletion may be written in, but growth taking place must also

be valued and the asset be written up in proportion to the growth. The initial point still holds true that no real depletion would take place.

As to the cost of railroad grades and logging roads, general accounting practice has charged these off to the current cut, making each thousand feet removed bear its proportional share. Obviously in a forest in which partial cutting is to be the practice, it would appear that such a charge would be too great a burden against the volume removed. Actually, under sustained yield these charges do not represent current costs but capital investments which are to be used ad infinitum. Thus the cost of these permanent improvements would be considered as investments. Then the only charge necessary would be the rate of interest which the money spent for the improvements might earn if invested elsewhere at current rates. The cost of this interest would be met by a charge against the cut sufficient to take care of interest accumulating during the cutting cycle. Actually, such a cost would be less than the depreciation charges under destructive logging because the higher value of the timber removed would easily absorb the differences.

Leaving out the social desirability of well managed forests as a motivating reason for the undertaking of commercial forestry by the industry, the trends of the present economic situation put forest investments in an attractive light. When these trends are combined with the results of financial research made in the past few years, the desirability of managing commercial forests on a permanent basis becomes a matter of sound business practice. If the industry continues to fail in its public responsibility with all this incentive, it will be clear that the lack of enthusiasm is not due to economic conditions but to inherent weaknesses within the system itself.

A Call for Help

DR. C. A. SCHENCK, Heidelberger Strasse 16, Darmstadt, Germany, is anxious to secure northern white pine seeds collected at various stations within the general range of the tree. One pound samples are desired. Exact information giving the point of collection should be given with each collection. The seeds will be used to determine the resistance of American strains of northern white pine to white pine blister rust. Many of Dr. Schenck's old friends in America undoubtedly will be interested in cooperating with him in this important study which will be carried on at Eberswalde and Munich in Germany and at Arnheim, Holland. Seeds and correspondence should be sent directly to Dr. Schenck.

POISONING CONIFERS IN STAND IMPROVEMENT AND TIMBER SALE PRACTICE

By G. A. PEARSON

Southwestern Forest and Range Experiment Station

The use of sodium arsenite solutions to kill worthless low-grade ponderosa pine trees is described. Holes five-eighths inch in diameter are bored in the tree and filled with the solution. The diameter of the tree determines the number of holes required. Although the work has not gone far enough to warrant final conclusions, the indications are that trees killed in this manner do not create a serious insect hazard, nor is there sufficient poison to be dangerous in the wood or needles of the killed tree.

ONE of the most perplexing problems of stand improvement in the Southwest is the disposal of relatively large, worthless, or low-grade trees. The cost of felling is a minor item. But once the tree is down it must be limbed, the brush handled and perhaps the bark peeled as a precaution against bark beetles. In addition to labor costs the felling of these trees, which are often of the extremely broad-crowned type, may damage valuable poles and saplings. In old, private cuttings defective, malformed or limby trees of saw-log size were left because they could not be removed at a profit. They have proved useful in natural reproduction, as attested by fine groups of young pine around or underneath their crowns; but once restocking is accomplished, a tree whose increment is without value becomes a liability which increases from year to year. In the Southwest, removal of dominating low-grade trees of all sizes, if it can be done cheaply, will yield big returns in saw-timber increment.

Various poison solutions are known to kill trees when introduced into the trunks. Sodium arsenite has been used extensively in clearing land of broadleaf trees in the South. At the Northeastern Forest Experiment Station the same poison has been applied to hardwoods in order to release the more valuable conifers or favored hardwood species. I have found no record of stand improvement or thinnings in which poison was used to kill conifers. When the idea was first proposed as a stand improvement measure in the Southwest it encountered the objection that bark beetles would breed in the dying trees. Nevertheless, it was decided to try out the method on a small scale in the Fort Valley Experimental Forest.

Preliminary Experimental Tests

In August 1934, a few pines of 6 to 9 inches d.b.h. were treated with a strong solution of sodium arsenite. The solution was poured into incisions made with an ax or with an improvised blade that opened a long, narrow slit in the bark and penetrated into the wood to a depth of about one-half inch. In the course of 2 or 3 weeks needles began to wilt but only some branches were thus affected. A second treatment increased the killing but still did not do a complete job. By the following spring all of the trees still retained a number of green branches and the inner bark remained fresh. It was feared that this condition would be ideal to attract Ips but no attacks materialized. A number of trees were felled in clearing the right of way for a road which approached within 200 yards of the poisoned trees. Ips attacked these down trees promptly and in force. Still no Ips borings appeared on the poisoned trees. Later in the summer one or two Ips beetles were found in a poisoned tree but that was all.

It was evident from the first attempts that the quantity of poison introduced had been insufficient. The solution that had been used approached saturation, or around 40 per cent, but only relatively small quantities could be made to stay in the openings made by chipping the bark. In the fall of 1934 additional trees were treated by pouring the solution into holes bored with a 1¼-inch auger. A prompt kill resulted. Some trees treated in November appeared unaffected through the winter, but died with the approach of growing weather the following spring.

In June, 1935, some 300 trees were treated. Holes of various sizes and numbers per tree were used. It was found that solutions of less than 5 per cent were generally ineffective, giving only a partial kill or leaving the tree apparently unaffected. Again the expected attack of Ips did not materialize, although felled trees were honeycombed with galleries. In September the trees which survived the first application were poisoned again, using a 12 per cent solution. Practically a complete kill was obtained. Needles began to wither in 10 days and within 3 weeks practically all the foliage was dead. Observations on these trees throughout the summer of 1936 revealed no Ips activity, although freshly felled trees again were attacked. The bark of the poisoned trees remained fresh through the greater part of the 1936 season, except in strips directly above each poison hole.

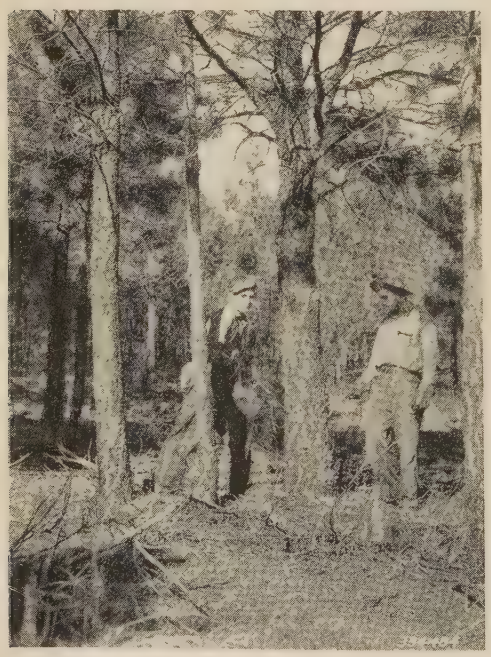


Fig. 1.—C.C.C. boys poisoning a low-grade tree which is dominating smaller trees of good form. The large tree has a crooked bole, sharply constricted about 10 feet above the ground as a result of old porcupine injury. The coarse, lower limbs have been removed; such limbs commonly contain the white mycelium of the western red rot, already in the heart of the tree.

Application in Timber Stand Improvement

During the season of 1936, between June 1 and October 15, a C.C.C. crew covered 380 acres in stand improvement, using poison almost exclusively in the removal of trees over 6 inches d.b.h. On an average, 12 trees per acre were poisoned and the same number cut. The sodium arsenite solution was prepared by dissolving 6 pounds "commercial grey" in 4 gallons of water. Holes were bored with a ⅝-inch bit, to a depth of 4 to 5 inches, directed tangentially as far as practical and inclined at an angle about 45 degrees below the horizontal. The number of holes was in proportion to the size of the tree, varying from 2 to 4 in trees between 5 and 12 inches d.b.h. and up to 10 or more in large trees. As a simple working rule, the boys were instructed to place the holes 8 inches apart around the bole, and in the case of very large trees to refill the holes about 15 minutes after the first filling. Generally two boys worked together, one cutting off obstructing branches and handling the poison while the other bored the holes (Figure 1). Practically a 100 per cent kill was obtained. In both 1935 and 1936 there were a few instances of

indirect poisoning; that is, trees which had not received an application of poison in the bole died, apparently because poison entered through roots grafted into those of neighboring poisoned trees. Partly to avoid this danger and partly to provide trap trees for Ips, a few trees above 6 inches d.b.h. were cut instead of poisoned. In previous years felled trees were strip peeled currently, but in this operation they were left until Ips broods were well under way and then peeled completely. The early-season cuttings were heavily attacked, but only in a few instances did stems cut after July 1 require peeling. Further trials are required to determine whether the trap trees were a major factor in checking Ips activity.

The cost consists of labor, poison, and equipment. Labor is by far the largest item. Extensive records of C.C.C. labor give a very high cost per tree. Short-time tests indicate that a seasoned laborer working alone can treat eight trees requiring 3 or 4 holes each per hour, including removal of interfering branches. At 40 cents per hour for labor and 1 cent per tree for poison the cost per tree is 6 cents. The cost of equipment is almost negligible. It consists of a carpenter's brace and $\frac{5}{8}$-inch bit, a bottle or can holding a gallon of poison, a rubber battery bulb costing 40 cents, and an ax for limbing.

Experiments under way indicate that the number of borings per tree can be decreased by increasing their depth to 7 or 8 inches and by increasing the strength of the solution. Experience indicates, however, that at least two applications are desirable, even in relatively small trees, in order to facilitate uniform distribution of the poison throughout the crown. The desirability of killing as much of the cambium as possible in order to discourage bark beetles is an additional factor against extreme localization of poison applications. These various questions are being made the subject of further experimentation.

Application in Timber Sale Practice

The handling of unmerchantable or low-quality trees is one of the factors contributing to low stumpage values in the Southwest. Moreover, it is seldom practical to go as far in the removal of minus-value stems as silvicultural considerations would dictate. On an area of 80 acres cut under Forest Service regulations in 1924, timber stand improvement in 1936 cut or poisoned 426 trees over 4 inches d.b.h. of which number 247 were from 6 to 11 inches and 71 over 11 inches, including a few over 20. Strict application of the minus-value principle would undoubtedly result in eliminating still more trees of saw-timber size. Present trends are toward less intensive utilization, which means either that the owner of managed timberland must pay, directly or in form of lower stumpage prices, for the removal of undesirable trees, or that such trees will be left in the name of selective logging to hamper the future stand.

Although tests thus far have dealt only with ponderosa pine, it is reasonable to believe that the poison method is also applicable to other forest types, where the problem may be largely one of eliminating inferior species, such as white fir in Douglas fir stands.

Effective timber management in the Southwest calls for stand improvement immediately following the logging. Release and pruning of crop trees will usually occupy a more prominent place than thinnings, as usually understood. The term "crop tree" should be interpreted liberally, to include not only poles but also saplings and even seedlings whenever they occur in spaces not occupied by larger trees of desirable form. Present indications are that poison can be used to advantage, as compared with

cutting, on trees above 5 inches d.b.h. that will not pay their way through available utilization channels. Besides economy in labor and avoiding felling damage, some positive benefits are obtained in poisoning. A poisoned tree deposits a deep layer of needles in the opening created by its death—a mat which will last at least 10 years. Analyses by the University of Arizona give assurance that there is no occasion for fear of poisonous residues in the needles or dead wood. The dead branches will support a substantial part of the snow load which, if the tree is felled, bends down the slender poles and saplings commonly growing close around or through the crown.

A fly in the ointment is the snag problem. Snag felling is standard timber sale practice in Region 3. But even if it becomes necessary to return 5 years after the logging operation to fell poisoned trees, definite advantages will have been gained. By that time the shielded young stems should be strong enough to stand independently. Further information is needed on this point, however. Felling a dead snag does less damage than felling a green tree. Admittedly it would be better, if fire danger permits, to let the poisoned trees stand. This may be permissible because most of the trees that will usually be poisoned are relatively short-boled and less likely to be struck by lightning than their taller live neighbors.

Conclusions

It is only fair to say that the poison method has not been tested long enough to warrant unconditional recommendation. Bark beetles may yet cause trouble. There have been indications of this on the Lincoln and the Prescott, both in abnormal bark-beetle territory. It is reasonable to believe, however, that the bark-beetle situation will take care of itself in going operations, as it does in continuous logging practice. In temporary or intermittent stand improvement, trap trees, as used in 1936, promise an effective means of control. The snag problem will have to be worked out. Experiments aiming at positive control of bark beetles, and refinements in the technique of applying poison are under way. Results obtained after 3 years of trial warrant the belief that sodium arsenite or other poisons capable of killing trees quickly will prove exceedingly useful in timber management.

American Society of Agricultural Engineers to Hold Annual Meeting

THE 31st annual meeting of the American Society of Agricultural Engineers will be held at the University of Illinois, June 21-24, inclusive. The subjects to be discussed include soils and water conservation with special reference to an extensive program in soil and water conservation work, special problems encountered in soil and water conservation work, results of experimental studies in soil conservation planning, terrace-project planning, and studies of machinery in relation to erosion control work. Drainage and land-use problems will also be discussed. Downtown headquarters of the group will be at the Urbana-Lincoln Hotel.

BRIEFER ARTICLES AND NOTES

Summer Meeting of Society to Be in Denver

The summer meeting of the Society recently approved by the Council will be held in Denver June 21-26 in connection with the regular summer session of the American Association for the Advancement of Science. Final details of the program are nearing completion. The foresters will join with the engineering societies of Section M in a discussion of watershed management and the influence of forest and range vegetation in regulating streamflow and controlling soil erosion. All papers will bear directly on this one outstanding phase of forestry. Present plans also call for a joint session of foresters, engineers, and members of the Hydrology Section of the American Geophysical Union to discuss such topics as the following:

The economic and social aspects of watershed management.

Summary of present knowledge concerning the use of water by vegetation.

Evapo-transpiration losses.

The velocity of water in relation to transportation of dead load.

Has man accelerated the rate of normal erosion?

Water supply in relation to altitudinal zones of precipitation.

Stabilization of streamflow as viewed by a forester.

Stabilization of streamflow as viewed by an engineer.

The foresters and engineers will be about equally represented in the selection of speakers. It is hoped that this plan will help foresters and engineers to gain a clearer understanding of the widely divergent (as now expressed) viewpoints of the two groups on water conservation, flood control, and the use of vegetation and engineering structures in stabilizing streamflow.

Several field trips are scheduled, on one of which the Central Rocky Mountain Section of the Society will be hosts at a barbecue lunch at the Manitou Experimental Forest. Field trips will include inspection of forest recreational facilities, Christmas tree thinnings, and timber sales, a forest tree nursery, water spreading and soil stabilization demonstrations of the Soil Conservation Service, an auto trip up Pikes Peak. Opportunities also will be afforded for visits to Rocky Mountain National Park, the Alpine Laboratory of the Carnegie Institution, and for field trips with Ecological Society members.

Professor Longyear Retires at Colorado State College

Professor Burton O. Longyear, who began teaching forestry at Colorado State College in 1904, and who has been associated with the department of forestry since its creation as a separate department in 1915 until this year, was recently honored for his many years of service to the profession of forestry and to the state of Colorado.

The occasion was the twelfth annual Washington's Birthday joint meeting of the Central Rocky Mountain Section, S.A.F., and the Forestry Club of Colorado State College, held in Fort Collins on February 20. At a banquet attended

by nearly two hundred colleagues, professional friends, alumni, and students, Professor Longyear was presented with a large bound volume of letters of appreciation from all who have known him and who have been associated with him in his forestry career. In addition, an oil painting of Professor Longyear, which now hangs in the reading room of the new forestry building at Colorado State College, was unveiled to the public for the first time.

Professor Longyear received the degrees of Bachelor of Science and Master of Forestry from Michigan State College. He was instructor of botany at Michigan State from 1893-1904, botanist for Michigan Agricultural Experiment Station 1903-1904, instructor of botany at Colorado State College 1904-1907, associate professor of botany 1907-1910, professor of Botany and Forestry 1910-1914, ex-officio state forester of Colorado 1911-1915, and associate professor of forestry 1914-1936.

Professor Longyear also instructed in the short courses for rangers of the U. S. Forest Service held at Colorado State College in the winter of 1906 under the direction of Prof. Hugh P. Baker, and in the winter of 1907 under the direction of Fred Morrell.

Interested chiefly in dendrological, silvicultural, and ecological studies, Professor Longyear has written many bulletins concerning the trees and other plants of Colorado. These include "Evergreens of Colorado", "Rocky Mountain Wild Flower Studies", and the Putnam handbook "Trees and Shrubs of the Rocky Mountain Regions". He is also a talented amateur ornithologist and a nurseryman and gardener of rare skill.

J. V. K. Wagar,
Colorado State College.

Federal Commission Recommends Extension of National Forests

Acquisition by the government of sufficient lands to establish and consolidate National Forests in regions where federal ownership of forest land will meet pressing economic and conservation needs, is recommended in the annual report of National Forest Reservation Commission, Secretary of War Woodring, president of the Commission. Three recommendations are offered.

1. Prompt establishment of federal ownership of forest land presenting peculiar problems of social and economic adjustments which demand early action and which cannot adequately be met by state or private agencies.

2. Consolidation of established National Forest purchase units to a degree permitting of their most effective and economical management by the Forest Service.

3. Extension of federal ownership and management into new territories in which requirements are not so acute as in the first case but where all the facts demonstrate that federal ownership and control are distinctly in the public interest.

The acquisition program under the Fulmer Act, passed by the 74th Congress, which authorizes federal cooperation with the states in establishing State Forests, has broadened the duties of the National Forest Reservation Commission, which also will pass on lands bought for incorporation into State Forests. Federal purchases for State Forests, under the Fulmer Act, are limited to $5,000,000 a year to be spent in a number of cooperating states. The Secretary of War points out that the development of State Forests alone will not be sufficient to meet the national need for forest conservation.

Sawed versus Hewed Ties

The Wind River Working Circle of the Washakie National Forest is managed upon a hewed-tie basis.

In the past serious objection has been raised to sawing ties out of large, crooked, and knotty trees as the cost was so much greater than for the production of hewed ties. However, the Regional policy does not allow the cutting of a timber stand for hewed ties alone and the operating company on the Wind River has installed portable sawmills to convert into sawed ties trees too large, knotty, or crooked for hewing.

Here, as in other parts of the Region, the production of sawed ties is increasing at the expense of the hewed-tie industry. This is probably due to the loss of the best timber for hewing through past operations which have left stands of timber of unsuitable size and character for hewing. The operating company on the Wind River is becoming reconciled to the production of sawed ties, as the difference in the cost of production of hewed and sawed ties does not now seem to be so great as in the past. This may be due to the higher price which they must pay for hewing or to the more efficient operation of the portable mills.

The production of sawed ties has several advantages both to the Forest Service and to the railroad company which uses the ties. The greatest advantage to the Forest Service would be in getting away from the mechanical marking policy in stands cut for hewed ties. The present policy is to remove all trees from the stand which would be too large for hewed ties at the time of the next cut. This is done by applying a fixed-diameter limit, without regard to the thriftiness and rate of growth of the trees. A revision of the marking policy would be most beneficial, in that a greater percentage of timber could be left for the next cut.

Sawed ties also are advantageous to the railroad company. They are more economical to treat because the desired absorption of preservative per cubic foot can be accurately determined, and because more ties can be treated in one operation due to their uniform size. Sawed ties are further desirable because they present a more uniform surface for tie plates and rails, and are more easily replaced in the road bed.

Carl F. Henderson,
Washakie National Forest.

New Trends in the Christmas Tree Business

The 1936 Christmas tree season on the South Platte District started on November 9 and closed on December 22. The cutting was done by an E.R.A. crew which was quartered at the Penley Ranch, three miles from the area. All of the season's cut was obtained from dense young Douglas fir stands on the steep north slopes of the Russell Gulch drainage. The majority of the merchantable trees were harvested in connection with original thinnings, although some selection cutting was done in stands which had been thinned in former years.

This was the most successful season, both from the standpoint of management and volume of sales, that has been experienced for some years. Quite a few orders were turned down because delivery could not be guaranteed on a specified date. This was due to the fact that during the greater part of the season there was a shortage of men, for instead of having a full crew of 30 men, only 15 or 20 were available most of the time. The majority of the men were inexperienced. With a larger crew and experienced men it would have been possible to produce a much larger number of trees. The number of acres thinned during the season cannot be stated, as a survey of

the thinned areas has not been made as yet.

A summary of the season's business is shown in Table 1.

Fifty tons of boughs were sold, rates being $1 per ton when picked from slash by the purchaser and $12 per ton delivered at the yard by the Forest Service. The total receipts for trees and boughs was $1,940.22.

A rather radical departure was made from past sales practice and method of handling the trees. The prices established for different sized trees are shown in Table 2.

This year the crew was instructed to save everything they cut which even faintly resembled a Christmas tree. These trees were hauled to the yard where they were trimmed up, graded, and tagged. Stalls were provided for each class of tree. Those trees which could not be used at all for Christmas trees were "snapped" and bundled as boughs. Those which were not good enough to put in one of the regular classes were stacked up and sold as culls at rates varying from .02½ cents to .12½ cents each. The 2,565 culls which were sold brought a return of approximately $134. Under former practice this material would have been left in the woods.

It was also found to be advantageous to work over the trees in the yard and to grade them when they were not frozen. This often made it possible to raise the rating of a tree. This is shown by the number of selects which were obtained this year as compared with the numbers cut in former years. This year 194 selects were sold in contrast to not over 10 or 15 for any previous year. When the trees were unloaded from the truck they were stood on end instead of being piled on top of each other. It is impossible to grade a tree that is crushed and frozen.

The best Christmas tree areas on the South Platte District have been completely thinned. Scattering, small patches make up the bulk of stands remaining for thinning. This condition is rather unfortunate at this time, since private lands no longer are able to supply the bulk of the Christmas tree demand. In years to come the Forest Service will be called upon more and more to supply trees. This means that it probably will be necessary for the Forest Service to engage in Christmas tree farming, using certain desirable sites just for Christmas tree production. The Forest Service should do this, as it is a perfectly legitimate Forest activity and the returns per acre will be far greater than if the land were used for sawlog production.

As a step in this direction, a selected area of three acres was clear cut during the past season. Ten interior plots are

Table 1

NUMBER AND SIZE OF CHRISTMAS TREES CUT ON THE PIKE NATIONAL FOREST

Height	Class	No. of trees
0-4	Firsts	2,195
0-4	Seconds	3,527
5-7	Firsts	1,952
5-7	Seconds	2,495
5-7	Selects	97
8-10	Firsts	570
8-10	Seconds	547
8-10	Selects	76
11-13	Firsts	72
11-13	Seconds	57
11-13	Selects	16
14-16	Firsts	18
14-16	Seconds	1
14-16	Selects	5
16 and over		4
Culls		2,565
Total		14,197

Table 2

PRICES OF CHRISTMAS TREES OF DIFFERENT SIZES

Height class	Firsts	Seconds	Selects
0-4	$0.10	$0.05	----
5-7	0.20	0.15	$0.30
8-10	0.35	0.20	0.50
11-13	0.45	0.25	0.75
14-16	0.50	0.30	1.50

16 plus at the rate of 15c per linear foot.

being established on the clear cut area to test the various forms of brush disposal treatment as they affect natural reproduction. The experiment will also include a test of artificial planting versus natural reproduction.

It is believed that it will be possible to demonstrate the practicability of growing valuable crops of Christmas trees on certain selected sites in the Front Range portion of the Pike Forest. If, by the example set, private landowners are encouraged to undertake the business, these efforts will be doubly rewarded.

R. H. Butler,
Pike National Forest.

An Implement for Preparing Seed Beds

Forest planting with nursery stock involves three cost items: cost of seed, cost of growing the seedlings, and cost of field planting. The second of these items forms a large percentage of the total and fluctuates most. The chief reason is the cost of hand labor. Large-scale operations with the use of machinery serve to reduce this cost item. On the other hand, increasing the size of the nursery to permit use of machinery, increases the rent and expense of watering, and may lead to the production of a lower grade of stock through less intensive care.

In the best planned, equipped, and managed nurseries hand labor is used chiefly in grading stock and in constructing seed beds. In the former human judgment is indispensable; but in seedbed construction an implement designed to meet the needs at the Georgia Forest School nursery makes possible a substantial reduction in the labor requirement.

This implement is called the Georgia Seed Bed Plow. It has worked very successfully as a substitute for the former slow method of construction with shovels, hoes, and middle buster plows and subsequent costly conditioning with rakes. Its advantages are not only that it is faster and cheaper; it also gives better uniformity in the size of the beds, and puts the surface in better condition for the seed.

Description of Operation

After the nursery is in condition for the construction of the beds i.e., plowed and the soil pulverized, the beds are laid off by plowing a single small furrow where the center of each path is to be. A common one-horse plow stock with detachable plows, using a round pointed plow, is best for this purpose. The distance between furrows should equal the width of a bed plus the width of a path. Furrows are not absolutely necessary in loose sandy soils; however, best results are secured by using them as they serve to guide the seed plow and better uniformity in spacing is obtained.

A weight of from one hundred to three hundred pounds is placed on the seed bed plow and it is pulled down each furrow by means of animals or a tractor. The sharp point of the plow pushes the soil to the sides where it is caught by the wings and distributed over one half of two beds thereby raising the beds. The return trip in the next furrow completes one bed and half of another. The weight needed and the number of trips necessary will be determined by soil conditions of course. One trip to each furrow is sufficient to prepare a good bed in loose soils. Some work with rakes at the ends and in the center of the beds may be necessary, but if the implement is correctly used very little hand labor is necessary before sowing.

The size and specifications of the plow given in Figure 1 have proven most adaptable for our nursery where practices differ from larger ones. We broadcast all seed by hand on flat beds raised about

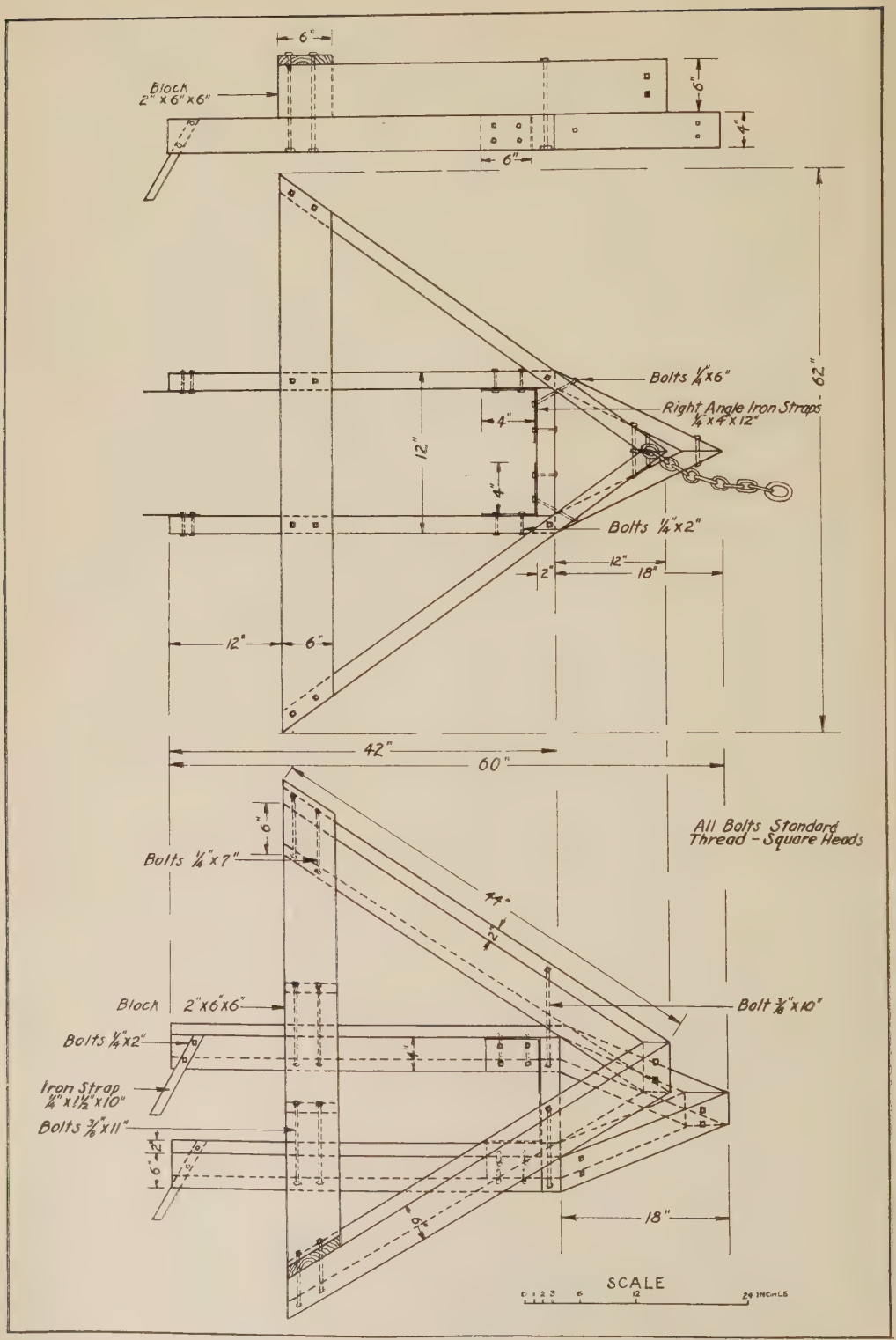


Fig. 1.—Details of construction of the Georgia Seed Bed Plow.

four inches above the paths. Beds are made fifty inches wide but the planted area is only forty-eight inches in width leaving a two inch shoulder on each edge to allow for sloughing. Paths are twelve inches wide.

Minor changes in construction of the seed bed plow will be necessary where the width of beds and paths used do not coincide with those given above. The wings of the plow can be tilted forward at the top for use in very loose soils. This tends to pack the soil slightly and prevents it from being pushed ahead of the wings. The keel on the rear of each runner holds the implement on a straight course. The construction of a few trial beds is recommended to determine the correct weight to use and the distance between the plow and motive power.

Togo B. McKeithen,
Georgia Forest School.

Utilization Possibilities in the California Pine Region

It is often said that the meat packing industries utilize every part of the butchered pig except the squeal. There may not seem to be any similarity between a squealing porker and a crashing pine, yet there is. Just as surely as this axiom is now true of the pig, so also will it be true for the wood-using industries of the future. Every part of the tree except the noise that it makes when it falls will be utilized. This is no myth. It is only a question of time.

Before discussing wood-utilization possibilities in the California pine region, permit me to review, for a moment, the advancements that have been made in other forest regions. For various reasons, these advancements may not be possible in California for some time to come. Twenty-five years ago they would have been considered impossible in these other regions.

The town of Cloquet, in northern Minnesota, has been a lumber manufacturing center for sixty years. For many years only the best of the white pine was logged, then Norway, and finally jack pine and other species. The number of sawmills increased to five, with a combined output of 250 million board feet per year.

Then in October 1918, came the great forest fire which virtually wiped out the entire town. Cloquet as an industrial center seemed to be a thing of the past. It was inconceivable that her people would return. Yet return they did. The owners of the various industries decided to rebuild—but this time on a permanent basis.

The sawmill capacity was restored to 150 million feet annually. A box factory was constructed. The toothpick factory used annually 2 million feet of birch in its daily output of 62 million toothpicks, 250,000 tongue depressors, 500,000 throat swabs, and 400,000 clothespins. Another factory uses large quantities of popple in the manufacture of matches and large quantities of birch for the boxes. The paper mill uses spruce, balsam, popple, and jack pine in the manufacture of book paper. Waste and other woods are used in making craft paper. A wood conversion plant was constructed to utilize the sawdust, screenings, and other waste material not utilized by the paper mill. This plant manufactures balsam wool—an insulation product—wall board, and a product known as Nu-wood. In addition to these factories there is a wood novelty plant manufacturing golf tees and other small wooden products. From toothpicks and matches to golf tees, there is no wooden article too small to claim the attention of Cloquet. Last summer the wood conversion plant bought from the Cloquet Experimental Forest thinnings down to a diameter of an inch and a half. Between the various plants there is a market for practically everything the

forest produces.

So much for Cloquet. The South has its Bogalusa, La., and its Crossett, Ark., which, while not quite so diversified in their manufacturing as Cloquet, have contrived, nevertheless, by specialty manufacturing and grouping of plants, to extinguish forever the fire in the refuse burner.

Now back to California again. What are our prospects for the future? We are farther removed from the markets. We do not have the variety of species. And we have, according to a recent estimate, a 75 years' supply of virgin timber still uncut. It seems reasonable to believe that what has taken place in other regions will also, in time, take place here. In 1934 there were 176 mills operating in the pine region of California. But 20 of these mills produced better than 80 per cent of the lumber output. The small mill cutting away here and there offers no permanency for the future. With them it is purely a cut out and get out policy. The same is true of several of the large mills. In fact, several of them have already nearly exhausted their supply of timber. For them there is no chance of sustained yield. Perhaps they were born too soon. It is the history of the past that little thought is given to the future until the raw product is about exhausted.

No one objects to a farmer burning his straw after the wheat has been removed. On the other hand, no farmer would burn his straw if it represented any immediate value to him. The same is true of the lumberman. Sawmill waste represents a zero value. Just as the straw and chaff are the refuse from the grains of wheat, so also are the slabs, sawdust, trimmings, and edgings a refuse from the log in the manufacturing of lumber. It is a necessary evil, costing nothing, valued at nothing. All that is necessary is to find a product into which it can be manufactured and sold at a profit and the progressive lumberman will utilize this waste. But here again it takes the sustained yield operation or at least the operation with a relatively long cut ahead. Complete utilization is possible only when highly specialized mills cluster around the larger mills and utilize their waste. No one of these specialized mills could profitably go into the woods for their raw material.

California is making progress. Box factories, planing mills, and lath mills (operated in conjunction with sawmills) are now utilizing much of the waste material that formerly went to the burners. Veneer and plywood plants and specialty manufacturing such as curtain rollers and other products are all doing their bit toward better utilization. One large company has recently developed a method by means of which the pitch can be extracted from clear high-grade lumber, thereby salvaging worthless material. It is said the value of the pitch extracted pays for the operation. This same company is experimenting with the compression of small clear squares of wood cut from No. 5 common lumber—the product to be used for flooring and as a substitute for tile. A Washington inventor has devised a machine to cut matched log cabin siding from six and eight inch poles. This offers a great opportunity in connection with future thinnings.

What about logging waste? Several milling studies have been made to determine the economic tree diameter. This has been found to fall anywhere between 16 and 24 to 26 inches, depending on the length of railroad or truck haul and other factors. Nevertheless, some mills are still logging trees below a diameter that will permit a profit. I have in mind one particular case where the orders came out to the woods to cut everything that would make a 2 x 4. Trees down to eight and ten inches in diameter were felled, limbed, and bucked. They are still there today. For some reason they were never logged.

The advancement in truck logging has done much to encourage better utilization. Fire-killed and insect-infected timber is now being salvaged, which a few years ago would have been considered impossible.

Why is it that some operators cut all the species common to a mixed stand, while others remove only the pine? The answer, of course, is that in the past they have found that they suffer a loss on the fir and cedar. Yet a year or two later another mill will set up to cut the cedar into pencil stock. If the second mill can make a profit logging only the cedar, it would seem that the first mill could also make a profit on cedar. A combination pencil stock and cedar log cabin siding plant operated in connection with a large mill at least offers possibilities.

This whole problem of utilization calls for planning, study, and intensive investigation. It needs a live and active sales force to ferret our new markets for small stock. As an example, the case of a hardwood mill in the South which could not move No. 3 common oak at $9 per thousand may be cited. This plant finally secured an order from a refrigerator company for small dimension stock for $75 per thousand feet. It required 4,000 feet of the No. 3 common to make 1,000 feet of dimension, and the converting cost was $14. A clear profit of $6 per thousand was secured on the original material, utilizing what had previously been unmovable material. It is markets such as this that need to be worked upon.

California has 965 secondary wood-using industries. Unfortunately these plants are not located at the mills where they can utilize the short stuff and so-called waste material. That is the problem of the future. The permanent wood-using community of the future will not exist on a sawmill alone. Clustered around the mill will be the paper mill utilizing the red and white fir and other mill waste, conversion plants, distillation plants, and other specialty manufacturing plants. This grouping and coordination of wood-using plants has developed in the older forest regions—it is not unlikely that it will also develop in California.

A. B. Everts,
U. S. Forest Service.

A New Profile Gauge

Profile charting of small gullies requires, for some purposes, a large number of evenly spaced depth measurements. This work can be greatly simplified, errors reduced, and time saved by using the inexpensive device shown in Figure 1.

This profile gauge consists of a piece of plywood to which are attached a number of even spaced rods that slide down when the board is held upright over a small gully. Details of construction are shown sufficiently well in the figure to enable anyone to reproduce the device. Disks on the bottoms of the rods prevent penetration of the rods into soft earth. A horizontal scale on the board indicates the depth, in inches or other units, to which each rod has dropped below the bottom of the board. In use, an end of the board is placed on each side of the gully. (When measurements at the same place are to be repeated it is advisable to place control points on each side of the gully. These hubs should be driven flush with the ground.) A clinometer on the back of the board can be used either to measure the slope from one side of the gully to the other or to level the bottom edge of the board.

The spacing of the rods, their length, and the size of the board can be made to fit the particular job for which the gauge is to be used. The gauge pictured is 18 inches by 21 inches, with rods 16 inches long spaced 1 inch apart. It was made for measuring the progress of silting-up of contour furrows where profiles of the

furrows were remeasured periodically at established points along the furrows. A slightly larger gauge could be used for small gullies. The device probably is not suitable for large gullies.

The gauge also might be used to measure the outlines of hummocks such as occur in overgrazed mountain meadows. For this use, the bottom of the gauge would be placed on top of the hummock.

H. D. Burke,
Rocky Mountain Forest and Range Experiment Station.

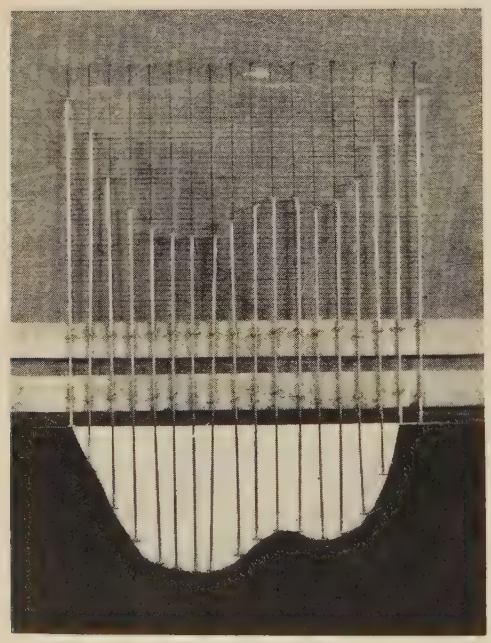


Fig. 1.—Profile gauge.

Erratum

In the article entitled "A Suggested Method for Allocating Logging Costs to Log Sizes", Journal of Forestry 35: 70 (January 1937) the fourth from the last number in the last column of Table 1 was erroneously printed 1.187 instead of 1.887.

A Correction

The statement made in my article entitled "Regional Distribution of Instruction in Professional Forestry" appearing in March 1937, Journal of Forestry with reference to undergraduate instruction in Duke University, Durham, North Carolina, is in error.

This statement reads: "At Duke University, North Carolina, a privately endowed institution, a fourth school for undergraduates has been started, with fair prospects of adequate support."

The statement appearing on Page 34, Professional Forestry Schools Report, is correct, and reads "a preforestry curriculum is available to undergraduate students in Trinity College of Duke University."

The instruction in forestry given at the University is entirely on a postgraduate basis.

H. H. Chapman.

REVIEWS

A Continent Lost — A Civilization Won. Indian Land Tenure in America. By J. P. Kinney. *365 pp. Illus. The Johns Hopkins Press, Baltimore. 1937. Price $4.*

For American foresters Kinney's new book is of special interest not only because its author is himself a forester but also because it includes an account of the Indian Office forest policy.

The book is essentially a history of our Indian policy from the beginnings of settlement to the present time; for land occupancy and land requirements have always been basic. The story is confined to what has gone on in our own country; Indian relationships in other parts of America are not considered. Within his chosen field, hitherto little worked despite the vast amount that has been written about the Indians and our treatment of them, Kinney has turned out an admirable and significant work of historical research. The resulting narrative is not only a thoroughly competent and highly illuminating presentation of his subject-matter but also a definite contribution toward an understanding of what is still an unsolved problem—the problem of what shall be done for and with the remaining Indians still needing special governmental care for their welfare.

The study does not extend to actual practices and field administration, but is concerned with laws and administrative purposes. Those who seek evidence of wrongs done the Indians, or of the ineptitudes of administration so often criticized by other writers, must for the most part read between the lines or look elsewhere. When such matters incidentally come into view, the soft pedal is likely to be put on. In 1831 the consent of the Cherokees to their removal from Georgia to the unsettled country beyond the Mississippi was obtained by "questionable methods", but was made effective only after an armed force was sent "to lend the necessary encouragement to emigration". In midwinter of 1870 United States cavalry attacked an encampment of Blackfeet Indians and killed 173, nearly one-third women and children; this "engagement, denounced by some contemporary whites as a massacre . . . did not enhance the reputation of the whites for fair dealing." When the Sioux grew bitter over the encroachments of civilization, "it must be admitted that not all white men were as considerate as they should have been." The impression may readily be gained from such euphemisms, combined with the conspicuous rareness of unfavorable comment upon the administration of the Office of Indian Affairs at any time throughout its history, that the author is either a partisan or inhibited by his official position from plain speaking.

That some inhibitions are necessarily introduced when an officer of the government writes about the history of his own organization is a matter of course. And that Kinney is in a sense an apologist for his organization—in the sense, that is, of defender of its cause—he himself makes manifest. But he is moved to defend by his convictions, based on what he has himself seen and participated in. A great deal has been written, he says, which has "presented only one side of the story" without a "clear understanding of the almost insuperable difficulties involved in the problem of adjusting the relationships

between the white and red races in America." Although the methods may have been bungling and ineffective and the policies pursued have surely been unscientific and temporizing, "much of the criticism heaped upon the legislative and executive branches of the government has been essentially unfair and unjust and in many instances the implied condemnation and open denunciation of public officials charged with the duty of administering Indian Affairs has been wholly unwarranted."

That Kinney inclines to show the other side is understandable. Those who wish complementary material can go, for example, to the publications of the Institute for Government Research, "The Office of Indian Affairs: Its History, Activities, and Organization", and "The Problem of Indian Administration". It is difficult to reconcile some of Kinney's judgments with the facts and conclusions recorded in these volumes. But in the main, the purposely restricted field of the study bars an evaluation of administrative performance as such, and explains the silences regarding it. To bring out the full picture would have called for a different undertaking.

In the field of policy, Kinney makes plain at the outset his conviction that the legislative and administrative courses pursued have almost unfailingly been inspired by a sincere desire to do the right thing by the Indians. Many readers will be unprepared either to take this for granted or to accept the author's word for it. On the whole, however, the narrative speaks for itself; the further one follows it, the stronger becomes the impression of good faith on the part of most of those who have shaped the course of Indian Affairs. The degree of intelligence, energy, and efficiency with which this governmental unit was handled under its long procession of short-term commissioners is another matter, of course.

The book opens with a chapter on Indian land tenure during the colonial period; and the second chapter deals with the agitation for removal of the Indians across the Mississippi which culminated in the wholesale forced migrations under Jackson's presidency. The dominating purpose of Indian policy through these two periods, during which land was still abundant, was to get the Indians to make room for the whites either by permitting the whites to take possession of land not actually needed for the maintenance of the Indians or by moving westward.

When one race presses into territory occupied by another, the hard fact has to be faced that both require land, and that in one way or another the resulting clash of interests must be resolved. It is to the great credit of the English colonies that they did not seek forcibly to dispossess the Indians, but from the outset recognized definite rights of occupancy as legally vested in the tribes. The same basic theory governed after the colonies became independent. The right of occupancy, however, was held to be limited to lands in actual use and only to enough land to meet actual needs. It was a case of "move over". If the bed then proved too narrow and displacement of the Indians became necessary, the consent of the tribes must be obtained and the new location must provide land adequate for their support.

After the federal government was formed, relations with the tribes were placed in its hands exclusively and were made a matter of treaty, like relations with a sovereign foreign power. In short, neither the British colonial policy nor that of the United States was a policy of expulsion, or extermination, or subjugation and enslavement, but contemplated the continued self-maintenance of the Indians, in whatever mode of life they chose, on land given over to their exclusive use. All this Kinney brings out clearly and with amplified detail.

The treaty period, during which the

Indian tribes had the legal status of domestic independent nations, lasted until 1871; but long before this radical changes in the actual relationship of the two races had been taking place. The succeeding reservation period, from 1871 to 1887, carried these changes much farther. The general aim of federal policy in both periods had two primary objectives: to open more land for white settlement, and to obtain safety for the whites against Indian forays or uprisings. Eventually the pressure of the whites for ever more land brought resort to a policy of segregation on specified and narrowing reservations. To obtain safety from Indian attack, two methods were employed—punitive warfare, and subsidization through supplying free food and other necessities. As the game supply shrank and many of the tribes were forced upon reservations where their members were unable to provide adequately for their own subsistence, the dependence upon federal handouts increased; and the diminished and enfeebled remnants of the once proud and wild aboriginal tribes with whom treaties had been solemnly concluded became wards of the government.

The heavy outlay entailed to care for them was a factor in bringing about a demand for a change in the policy. Primarily, however, it was the public conscience which, aroused by the degradation into which the noble red man of romance was sinking and the sense of wrongs perpetrated, clamored for measures of rehabilitation. In the eyes of the reformers of the 'seventies and 'eighties, the answer was civilization and absorption through breaking down the old tribal organization, educating for citizenship, economic independence, and individual property ownership, and distribution of the common property. So came the allotment period.

It was by no means a novelty. The Massachusetts Bay Puritans had provided in 1633, as Kinney shows, that "if any of the Indians shall be brought to civility, and shall come among the English to inhabit, in any of their plantations, and shall there live civily and orderly, that such Indians shall have allotments among the English, according to the custom of the English in like case." Eventually, however, the proved inability of the Indians of New England when given the full possession of property in severalty to retain it made it necessary, in their interest, to extend a form of guardianship over them like that provided for minor children and mentally incompetent white adults. In short, the Indians, by and large, have shown most extraordinary resistance to being assimilated into the body of the civilized white economic and social organization for which they have been asked to give up their tribal institutions and ancestral ways; and the vaunted benefits of individual property ownership as a means of developing independence, thrift, and like Anglo-Saxon virtues have proved in large measure illusory, though as a means of transferring the red man's heritage to his enterprising white brothers it has been a gold mine.

To the evolution and the fruits of the allotment policy Kinney devotes nearly half of his book. Successive chapters are entitled "early indications of an allotment policy", "experimentation with an allotment policy", "the acceptance of a general allotment policy", and "allotment purpose defeated by lease and sale". An illuminating appendix table shows how far allotment has gone. In 1881 the Indian lands totaled in round numbers nearly 15 million acres, 139 million tribal and 17 million allotted. In 1933 86 million out of the original 156 million acres had passed from the Indians through cessions or being thrown open to settlement as "surplus lands"; tribal lands totaled less than 30 million acres; allotted lands held in trust, 18 million; and allotted lands alienated, 22 million. What proportion of the 40 million acres of allotted lands, whether still held in trust

for the individual allottees or made over fully to their control, is under lease to whites or, where alienated, has been sold to white men the table does not show; but obviously the process of distribution has gone far in cutting down the area of tribal lands.

"A Continent Lost — A Civilization Won", says Kinney at the top of his title page. So, too, at the very end: "The future of the race is in the hands of the individuals of the race. The American Indian has lost a continent but has won a civilization." This sounds like unqualified acceptance of the theory that lay back of the allotment policy; and the civilization that has been won would seem to be the white man's competitive individualism. The New Deal, however, brought to the head of the Indian Office a Commissioner under whom the pressure to speed the dissolution of the tribal ties and the conversion of all the Indians into independent American citizens owning their property individually has been relaxed. It is recognized that the land now available for the support of the Indians in their own way of life is in many cases inadequate, particularly where depleted grazing lands are involved; and effort is being made to add to the reservations. With this policy, conservation of resource values for the benefit of the Indians attains new importance.

The development of reservation resources is the theme of Kinney's longest chapter (Chapter 7). Save for a brief final summarizing chapter entitled "The Past, the Present, and the Future", it brings his narrative to its end. The question of applying a policy of conservation on Indian lands came up first in connection with the timberlands. Kinney's leadership and long uphill fight to save for the Indians their forest resources and get them under sound management practices is well known. The allotment system and the pressure to cut down the reservations in order to open more land to white acquisition were the two greatest obstacles, partly thwarting his efforts. That he was able to accomplish as much as he did, through quiet persistence in the face often of heavy discouragements, is everlastingly to his credit. The story is told with much modesty, considerateness for others, and some reticences which leave the record incomplete. Another's hand will be required to bring into full light what is really due the protagonist in the struggle to save the Indian forests for the Indians, and in perpetuity. Also, Kinney is exceedingly circumspect in dealing with the forestry work on Indian reservations inaugurated under the Forest Service, which had a prominent place in the Pinchot-Ballinger investigation; even his footnote references on this are both inadequate and one-sided and the text walks around the whole subject very gingerly.

Taken as a whole, this book is not only a valuable and highly creditable piece of work—that is too faint praise; its production by anyone not engaged solely in the work of historical research makes it a marvel of industry and precision; it is a solid contribution to American history; it is a rich mine of information; it is well planned, well balanced, well written, well documented. Not the least interesting thing in it is a reproduction of a map and accompanying key compiled and first published by the University of California Department of Anthropology, which shows the original location of more than 350 North American tribes.

To end on a note of complaint is ungracious; yet the imprint of the Johns Hopkins Press ought to be a guarantee that a book of this character would not be marred by flagrantly careless proof reading. It is a misfortune that in this important matter Kinney was not better served; otherwise his publishers did well by him.

HERBERT A. SMITH.

Rich Land, Poor Land— A Study of Waste in the Natural Resources of America. By Stuart Chase. Maps, diagrams, and end paper design by Henry Billings. *361 pp. Illus. Whittlesey House of McGraw-Hill Book Co., Inc., New York and London. 1936. Price $2.50.*

Will Durant in a recent lecture gave soil as the first and basic concern of us all. Social, spiritual, economic, and political conditions are all of less significance; or rather, are dependent on the soil and hence subordinate. Soil resources, he states, have determined the rise and fall of all civilizations.

"Rich Land, Poor Land" is a potent means of impressing on the general public the development of soil and natural resource impoverishment and the possibility and means of repairing or delaying it. The jacket of the book is so cleverly designed that one is loath to discard it. Within the front and back covers are pleasing maps of the planned and unplanned river valley. The plates, maps, and figures are ingenious and attractive and the format of the text is a credit to author, publisher, and printer.

The text presents a unified picture of the soil and the interdependence on it of water, vegetation, animal life, and human existence from the simple dependence for food into intricate problems of employment, power production, and social movement. What Van Loon did for geography Stuart Chase has done for soil science. The reader can pleasantly learn the unpleasant problem of conservation and some of the means of solving the riddle. The layman can understand what is going on, and with that understanding he will undoubtedly gain interest in land whether he owns it personally or counts it his possession as part of the public domain. Unfortunately the tenant, too often, holds the fate of land in his hands and the owner does not exercise his right of control. Arthur Young is quoted as saying that "an owner's self-interest would prompt him to convert a desert into a garden, but give him a nine-year lease on a garden and he would reduce it to a desert."

But would he work such desolation if he saw the outcome of it? Who wants to live in Ducktown, "the symbol of a logical end of an undirected machine age," "the future of America in the event of a decision to let the trends of the past continue unaltered?"

Industrialists and economists should be especially interested in the chapter "Five million jobs."

The author's opinion of the Forest Service can best be given by quotation:

"Napoleon, when the battle wavered, threw in the Old Guard, the seasoned troops. In the same way the Forest Service is the seasoned corps which stiffens, instructs and frequently salvages the errors of the green new armies of conservation. It has been through the wars for a generation, ever since Gifford Pinchot first let it into battle. It bolsters the C.C.C. camps, the erosion services, the T.V.A., the public-works brigades, the Resettlement Administration in Sublimity Forest and elsewhere. It writes reports for the National Resources Board. It helps lead many Indians back into their ancient way of life, where they are happier than in tin-roofed bungalows trying to keep up with the Joneses. One cannot go far in any conservation service without encountering a forester, and a feeling of —how shall I put it?—stability.

"The Forest Service must know its stuff. It has the biggest tree job in the world. It is responsible for the management of 160 million acres of forest land. It cuts a billion feet of timber a year. Eight million head of cattle are grazing on its domain. It is fighting fires not only in its own vast empire but in all American forests. Seven hundred cities and towns are dependent on its forests

for their water supply. Twenty million people take advantage of its recreation facilities every year. Like the Coast Guard, the Forest Service attracts a superior type of human being, a happy combination of woodsman and scientist. It is fitting that the Forest Service laboratory at Madison, Wisconsin, should be one of the most beautiful examples of modern architecture in the world."

Similarly, his view of T.V.A. can best be given in his own words:

"The T.V.A., at the present stage of what historians may some day call the Great Transition, must inevitably be a compromise—as the navigation clause which legally justified it is a compromise —between what is and what is to be.

"Compromise or no, to see the Authority in operation is a spiritually refreshing experience. To look at the clean, strong walls of Norris Dam between the hills of pine; to feel the will to achievement, the deep integrity of a thousand young-minded men and women, schooled in the disciplines of science, free from the dreary business of chiseling competitors and advertising soap; to realize that resources are building rather than declining and that the continent is being refreshed; to know that, over this whole great valley from the Smokies to the Ohio, men's faces turn to a common purpose and a common goal—intoxicates the imagination. Here, struggling in embryo, is perhaps the promise of what all America will some day be."

Stockholders in southern utilities affected by the T.V.A. will find illuminating arguments for its existence and extension, and will probably be moved to consider whether we live for the moment or desire to contribute to the future by a present sacrifice. Some sacrifice of selfish interest is necessary if we are to pass any heritage of lasting worth to our successors.

Those who are aware of national problems should read this book to clarify their thinking about them (and incidentally to provide material for stimulating conversations and proof for arguments). Then they should see that those unaware of these problems get an introduction to the book.

C. Eunice Skamser,
Rocky Mountain Forest and Range Experiment Station.

The Useful Plants of West Tropical Africa. By J. M. Dalziel, *612 pp. The Crown Agent for the Colonies, Westminster, London. 1937. Price 18S.*

This comprehensive work is an appendix to the Flora of West Tropical Africa by J. Hutchinson and J. M. Dalziel. It deals with the economic uses and the vernacular names of the native plants of Gambia, Gold Coast, Nigeria, and Sierra Leone that are used for food, drugs, and other useful purposes.

The book is based on the author's field notes over a period of thirty years. Despite the author's great interest in medicinal plants, the discussion of the commercially important trees is unusually detailed and comprehensive. The various vernacular names applied in the different colonies to each tree are given as well as the accepted common names. In most instances a detailed description is given not only of the tree itself but of the character, properties, and uses of the wood.

The work is authentic, comprehensive and replete with detailed, useful information not available elsewhere on economic plants. Anyone interested in the useful plants of west tropical Africa will find this book an indispensable source of information.

Henry Schmitz,
University of Minnesota.

A General Outline of Forestry with Special Reference to the United States. By Percy M. Barr; revised by Robert A. Cockrell. *158 pp. (Mimeo.) Univ. of California Press, Berkeley, Calif. 1937. Price $1.25.*

There is a real need in American forestry literature for a carefully written, well balanced text on general forestry but unfortunately the decision as to just what and how much to include in such a book is not easily made. In fact, determining its scope is probably the most difficult task in its writing. As pointed out in the Introduction to this text, ". . . forestry is not a unified and clearly defined branch of human knowledge . . . but a general subject based on several sciences, including in its application various modifications of engineering and industry, and requiring for its proper development in either a nation or a local community, a thorough understanding of certain aspects of law, economics, government, and financial practice." In addition, the type of student group for which such a text is designed will obviously exert considerable influence on the method of treatment and emphasis to be placed on the varying phases of the subject.

In preparing this treatise, the authors have mastered the problem of dealing with a subject of such wide scope by the simple expedient of breaking it down into four parts, the first of which is General and the other three dealing with the Technical, Administrative, and Social Aspects. In some ways this grouping is unique, but it is well thought out and enables the authors to present a complete picture of the whole field of forestry in a logical, yet concise manner. Under each group are included brief discussions of each of the many phases of forestry falling in that category. For example, Part 2 deals with technical subjects, such as Dendrology, Silviculture, and Forest Mensuration, while Part 3, Administrative Aspects, includes sections on Management of Forests for Timber Production, Range Management, Wild-Life Management, and Management of Forest Recreation. Part 4, Social Aspects, includes Forest Economics, History of Forestry, Forestry in the United States, and the Profession of Forestry.

If this text is designed for use primarily by students in professional schools of forestry the methods of treatment and emphasis are excellent. It is well-written, concise, yet very complete and is given a modern slant through the grouping together of the current social and economic ideas of forestry. In some instances there is a tendency to expand a subject and become too detailed but such cases are in the minority and not of serious import. The book is remarkably free from typographic errors, so common in mimeographed manuals. On the whole this is one of the most thorough treatments of the general field of forestry yet to appear.

If, however, it is hoped that this text will be used by students other than in professional forestry schools, such as in elective cultural courses in purely academic colleges, as is intimated in the announced intention that the text "serve as an outline for an elementary university course in general forestry . . .", it is believed that considerable rearrangement and shifting of emphasis is desirable. The economic need for forestry and its ramifying social aspects might well be considerably expanded and perhaps be placed first, followed by a briefer section on the purely technical aspects. The inclusion of a section on the Profession of Forestry, with its already antiquated data on schools, enrollment, employment percentages by organizations, salaries, and emphasis on the healthy, out-of-door type of life, is questionable.

The unique, logical manner in which administrative management functions have been grouped together and the way in

which the subject of silvics has been handled are of special interest. The field of silvics has been split into three parts: the form and development of forests; factors affecting establishment and life history of forests; and the effect of forests upon their surroundings. The first two of these have been combined under the heading Forest Ecology, with the third separated out as Forest Influences. Silvics, as such, no longer appears.

WILLIAM MAUGHAN,
Duke University.

Harvesting and Marketing Timber in New York. By Raymond J. Hoyle. *N. Y. State College of Forestry, Technical Pub. 49. 186 pp. Illus. 1936. Price 75c.*

This is a valuable contribution to a badly neglected phase of farm forestry. Few foresters will take issue with Professor Hoyle when he says, in his Introduction, that "the failure in marketing is one of the chief reasons why private forestry has not been practiced to any extent in this state (New York) and particularly on the farm woodlands." He might have added, with equal truth, that foresters have devoted too little time to the problems involved in farm-timber marketing. Rarely does the subject of farm-timber marketing come up for discussion at meetings of foresters; even when it is on the program the time allotted is often cut short, with the result that little or no progress is made.

This apparent lack of interest on the part of foresters is especially evidenced by the dearth of published information which the small forest owner can use in determining the best markets for his timber. A number of publications somewhat similar to Hoyle's have been prepared for other states; however, all but three or four of these are twenty or more years old. The U. S. Forest Service has a Farmers' Bulletin dealing exclusively with the marketing of walnut timber. It also has one on the measuring and marketing of farm timber, which is necessarily limited to a few of the more important products.

Hoyle's publication first takes up the problems involved in the sale of timber and discusses the advantages and disadvantages of different ways of marketing, as for instance, the form in which it should be sold and whether by "lot", "piece", "log scale", or some other unit of measure. Following this general treatment of marketing, detailed information is given for all the various timber products, including "veneer logs", "handle logs", "mine timber", and the like. A chapter is devoted to each product, with a full discussion of species, grades, sizes, harvesting, storing, transporting, prices, markets, and forestry aspects. The size and general quality of forest material required for the different products are also illustrated by many excellent photographs. Figures on costs of production and prices, including a large amount of original data, are a particularly valuable feature, as they make it possible for the owner to determine the probable return from his timber.

Publications of this kind, which in the nature of the case cover a wide range of products, might well include a ready reference table showing for each product the character of material required, such as kinds of wood, sizes, and allowable defects.

It is to be hoped that Hoyle's publication will be followed by similar ones for

other states. A series of such bulletins would be an effective means of encouraging the practice of forestry on the farm woodlands which, after all, embrace fully a fourth of our total forest land.

W. D. Brush,
U. S. Forest Service.

Factors Controlling Initial Establishment of Western White Pine and Associated Species. By Irvine T. Haig. *Yale Univ., School of Forestry Bull. 41. 149 pp. Illus. 1936. Price $2.50.*

The relation of site factors to seedling mortality was investigated at the Priest River Experimental Forest, Idaho, in 1932, 1933, and 1934. Western white pine (*Pinus monticola*) and five associated species, among them western larch and Douglas fir, were studied. The conclusions here cited apply to findings on a large, exposed river flat where most of the work was done.

Seed were sown in "full-sun", "part-shade", and "full-shade". Mortality in all three situations was high during the first seedling year. It was highest in the full-sun, next in full-shade and least in part-shade. Deaths in full-sun were attributed mainly to excessive heat of insolation, those in full-shade to drouth.

In both full-sun and full-shade upon immediate causes of death are stressed rather than what might be considered underlying causes. The soil dried out more rapidly in full-sun than in full-shade. One might assume from this that the high mortality in full-sun was due to deficient moisture. But for the purpose of this study the damage was attributed to insolation because many of the dead seedlings showed characteristic heat lesions resulting from high surface soil temperatures. Similarly, in full-shade the mortality was attributed to drouth, notwithstanding a higher soil moisture content here than in full-sun, because it was found that the roots of the dying seedlings had been unable to penetrate downward fast enough to keep pace with the slowly receding level of available soil moisture.

Haig's findings in the northern Rocky Mountains are quite in accord with my records of the behavior of ponderosa pine in the Southwest, but our interpretations are different. In comparing notes it should, of course, be recognized that ponderosa pine probably has greater drouth resistance and lower shade tolerance than western white pine. Nevertheless, certain principles are common to all species. Loss of ponderosa pine in open situations in Arizona is attributed more to drouth than to insolation because, although heat lesions are not uncommon in ponderosa pine, anything which increases the soil moisture content, such as removal of herbaceous vegetation, lowers the rate of mortality. Perhaps the same effect could be accomplished by applying artificial shade, which would tend to preserve a favorable water balance. Viewing the subject from this angle, the investigator might be justified in saying that insolation is the unfavorable factor. But it is known that ponderosa pine requires rather high insolation for normal development, even in early life. Shade exceeding 50 per cent gives higher germination but lower survival and weaker development than full-sun. Even such recognized shade species as blue spruce and Engelmann spruce do not develop normally where as much as 75 per cent of the insolation has been intercepted.

That deficient insolation lies behind the immediate cause in the failure of white pine and associated species in full-shade is recognized by Haig when he says, "Light may, however, be an important indirect factor in survival through its effect on growth, particularly on initial root penetration." If seedlings hav-

ing an abundant moisture supply within 3 inches of the surface, as shown by the soil moisture measurements in full-shade, are unable to reach down and help themselves to it there must be a reason. Nursery experiments in the Southwest have shown that Douglas fir, a relatively shade-tolerant species in this region, forms poorer roots in half-shade than in full-sunlight.

Plant reactions to insolation are complicated by the fact that changes in degree of insolation are accompanied by changes in temperature and moisture. Conclusions may vary according to the angle of approach and the purpose of the investigation. In forest management, it is essential to bear in mind certain facts on which all are agreed. Insolation furnishes the energy whereby trees are able to elaborate their food from raw material. It also exercises an important influence on form. Water acts as a solvent, a transporting medium and a cooling agent. Water absorbs and dissipates excess heat in a plant as it does in the cooling system of a gasoline motor. A pine seedling in dry soil and full-sunlight may be likened to a motor which has plenty of gasoline but an empty radiator; a pine seedling in dense shade may be likened to a motor which has a full radiator but an empty gasoline tank.

G. A. Pearson,
Southwestern Forest and Range Experiment Station.

SOCIETY OF AMERICAN FORESTERS

First Summer Meeting, Jointly with the

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Denver, Colorado, June 21-26, 1937

Meeting Headquarters: Cosmopolitan Hotel

Monday, June 21

Morning

Registration. Society members should register at the Association registration desk in the Cosmopolitan Hotel and pay the $1.00 fee. Further details about the meeting, lodging, and field trips may be obtained at the desk.

Afternoon

Joint session with Section M (Engineering Societies). The program, to be provided by the engineers, will be on the general subject of water in relation to agriculture, with special reference to irrigation and the trans-mountain diversion of water for agricultural purposes.

Tuesday, June 22

All Day

"The Economic and Social Value of Watershed Management." Charles A. Lory, President, Colorado State College of Agriculture and Mechanic Arts, Fort Collins, Colorado.

"Vegetation as a Factor in Losses and Yields of Water." Joseph Kittredge, Professor of Forest Influences, University of California, Berkeley, California.

"Evapo-Transpiration Losses." R. L. Parshall, Senior Irrigation Engineer, Bureau of Agricultural Engineering, In Charge of Irrigation Investigations, Colorado Agricultural Experiment Station, Fort Collins, Colorado.

"Epicycles of Erosion." Reed Bailey, Director, Intermountain Forest and Range Experiment Station, Ogden, Utah.

"Changes in Land Ownership and Land Use Patterns Needed for Better Watershed Management." W. C. Lowdermilk, Associate Chief, U. S. Soil Conservation Service, Washington, D. C.

"Altitude vs. Percipitation and Run-Off in the Rocky Mountain Region." F. C. Hart, U. S. Bureau of Reclamation, Denver, Colorado.

"Stabilizing Streamflow as Viewed by a Forester." C. L. Forsling, Assistant Chief, In Charge of Research, U. S. Forest Service, Washington, D. C.

"Stabilizing Streamflow as Viewed by an Engineer." Robert E. Horton, Consulting Hydraulic Engineer, Albany, N. Y.

Wednesday, June 23

All Day

Field trip to logging operations, thinning demonstrations, Christmas tree plantations, forest nursery, recreational developments, forest fire lookout, erosion-streamflow experiment station, and Pikes Peak. Barbecue lunch at Manitou Experimental Forest. Return to Denver Wednesday evening.

Those who want to see the water spreading demonstrations of the Soil Conservation Service should plan to spend the night at Colorado Springs, completing the return trip to Denver about noon on Thursday.

Thursday, June 24

Morning

Completion of field trip for those electing to spend Wednesday night at Colorado Springs.

Friday, June 25

Afternoon

Excursion to Denver Mountain Parks

Saturday, June 26

All Day

Trip to Rocky Mountain National Park

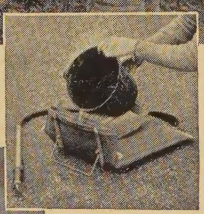
Fight Fire More Efficiently

WITH THE RANGER-SPECIAL

Reg. U. S. Pat. Off.

WATER BAG AND HAND PUMP

Comfort . . . . Unlimited Life . . . . 100% Efficient



The RANGER-SPECIAL Water Bag is form-fitting fabric knapsack. The outside jack is seamless and bonded to a thick rubber linin by a vulcanizing process which makes it leak proof. IS AN EXCELLENT INSULATO AGAINST COLD AND HEAT. The operato need not fear any ill effects caused by temper ture of water.

The RANGER-SPECIAL eliminates all phys cal strain. It will not hamper free movement chafe the back, as it is a soft and non-rigid ba Scientific distribution of load prevents pull-bac of shoulders. Automatic deflation as water pumped out avoids all tendency to throw th operator off balance.

Due to the flexible nature of the RANGE SPECIAL bag it will withstand rough treatme without damage. The outfit will not be affecte by severe atmospheric and hydro-chemical conc tions. The few metal parts are non-rusting.

FEATURES THAT COUNT

1. Made of seamless fabric (not metal), it fits wearer's ba like a cushion—no chafing; no discomfort. Absolutely leakage or splash.
2. Bag automatically deflates as water is pumped out — slapping or swaying of water load.
3. Water load is carried lower than in metal tanks—prever "pulling" at shoulders. While this is ordinarily called 5-gallon water bag, it is possible to carry as much as 6 gallons.
4. Unique hand pump (choice of 3 styles) forces steady, stro 50 ft. stream—extinguishes blaze from safe distance.
5. Complete dimensions (rolled up) 20 in. x 7 in. x 5 in. Y can store 3 to 5 RANGER SPECIALS where you wo store one metal tank.
6. Improved closing device enables operator to easily put ha into bag and remove sticks, leaves, etc.

Also WAJAX High Pressure Portable Forest Fire Pump, Ranger-Special linen Forestry Hose and accessories.

FENWICK-REDDAWAY MANUFACTURING CO.

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